

SAMSUNG

GSM TELEPHONE

GT-C3510

***SERVICE* Manual**

GSM TELEPHONE



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**SAMSUNG
ELECTRONICS**



GSPN (Global Service Partner Network)

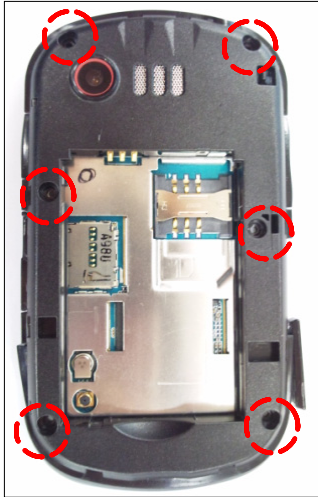
Country	Web Site
North America	service.samsungportal.com
Latin America	latin.samsungportal.com
CIS	cis.samsungportal.com
Europe	europe.samsungportal.com
China	china.samsungportal.com
Asia	asia.samsungportal.com
Mideast & Africa	mea.samsungportal.com

11. Disassembly and Assembly Instructions

11-1. Disassembly

1

1) Unscrew the 6 points.

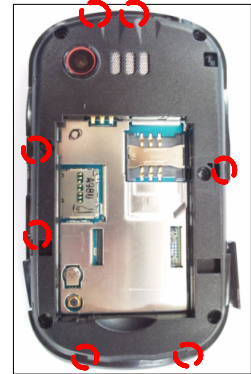


※ Caution

1) Be careful not to make scratch and molding damage.

2

1) Separate the rear case.



Be careful not to damage the SMD material.
Don't use DISASSEMBLE JIG deeply.

※ Caution

1) Be careful not to make scratch and molding damage.

3

1) Perform TSP FPCB visual check

After
disassembling the
rear case, check
the TSP FPCB
damage.



※ Caution

1) Be careful not to make damage to INTENNA

4

1) Separate the LCD connectors, then
unhook at the 4 points.

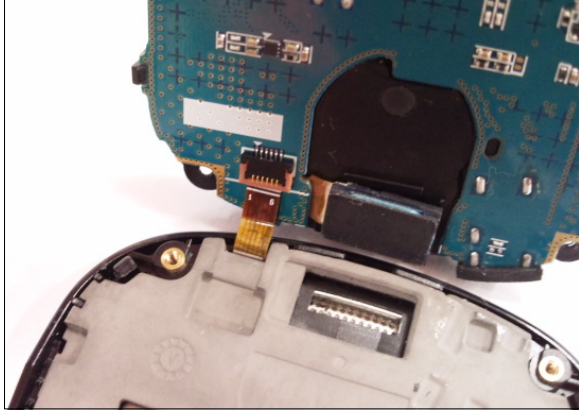


※ Caution

1) Be careful not to make scratch and molding damage.

5

- 1) After lifting PBA upward, disassemble TSP FPCB under the board.

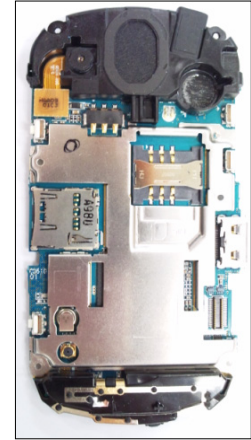


※ Caution

- 1) Be careful not to make scratch and molding damage.

6

- 1) Separate PBA and the front Assembly.

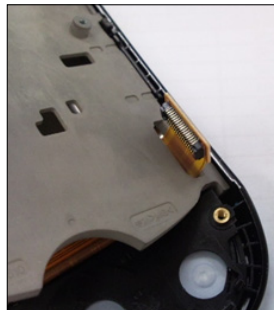
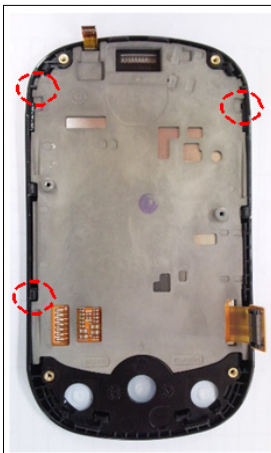


※ Caution

- 1) Be careful not to make scratch and molding damage.
- 2) Be careful not to damage the PBA.

7

- 1) Separate bracket hooks on 3 points
- 2) Separate LCD connector from the bracket.



※ Caution

- 1) Be careful not to damage LCD FPCB.

8

- 1) Lift LCD top and separate it from the front case.



※ Caution

9

- 1) Disassemble intenna's left/right hooks on 2 points.

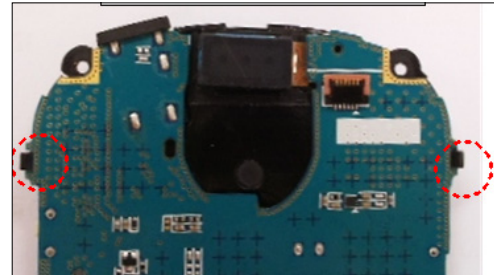
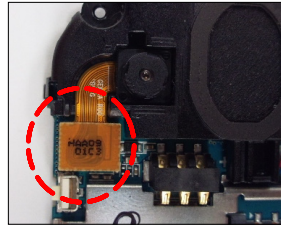


※ **Caution**

- 1) Be careful not to make intenna hook damage.

10

- 1) Separate camera connector.
- 2) Disassemble SPK Carrier's left/right hooks on 2 points and remove solder.

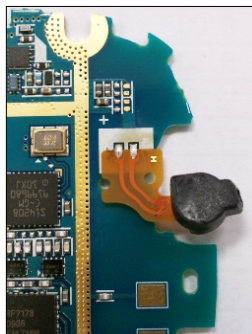
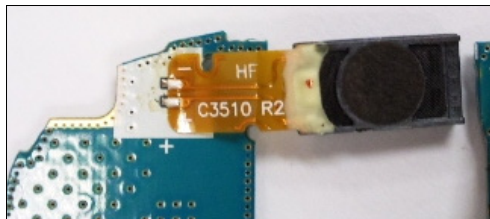


※ **Caution**

- 1) Be careful not to make SPK Hook damage.

11

- 1) Remove RCV/MIC solder.

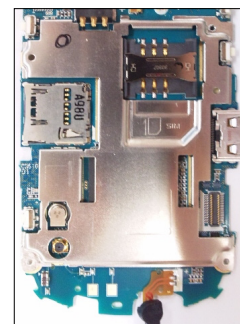
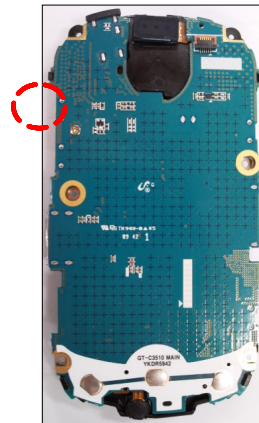


※ **Caution**

- 1) Be careful not to damage FPCB.

12

- 1) Remove screw at 1point
- 2) Separate the motor/shield can from the PBA.

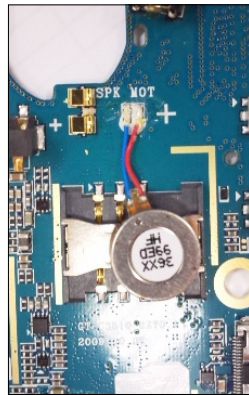
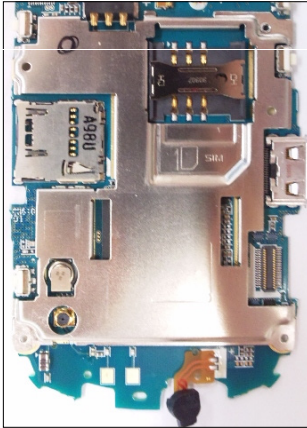


※ **Caution**

11-2. Assembly

1

- 1) Assemble the shield can and screw at 1point
- 2) Solder the motor

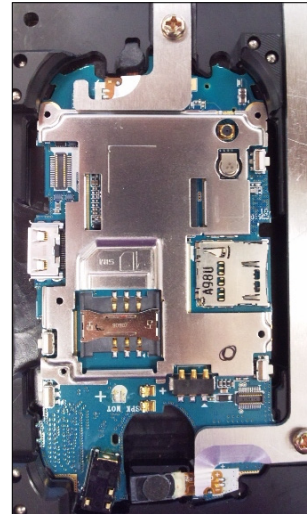


※ Caution

- 1) Be careful not to damage the FPCB.

2

- 1) Solder the receiver and Mic.

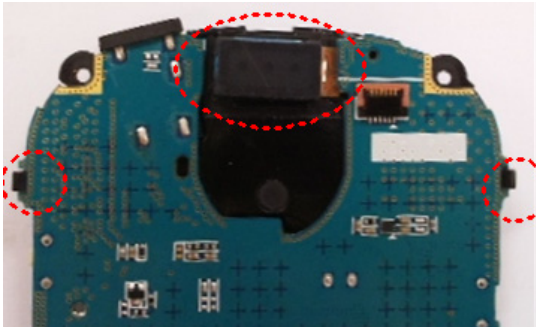


※ Caution

- 1) Be careful not to damage the receiver FPCB & SPK WIRE.

3

- 1) Solder and assemble the speaker module and PBA.

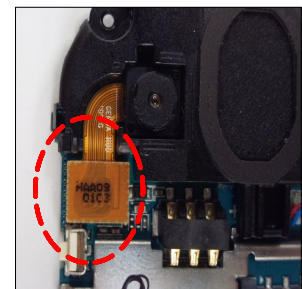
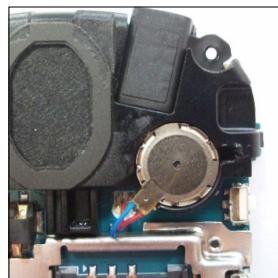


※ Caution

- 1) Confirm receiver's location
- 2) Be careful not to make SPK Hook damage.

4

- 1) Assemble the camera carrier.
- 2) Assemble the motor.



※ Caution

- 1) Be careful not to damage PBA.

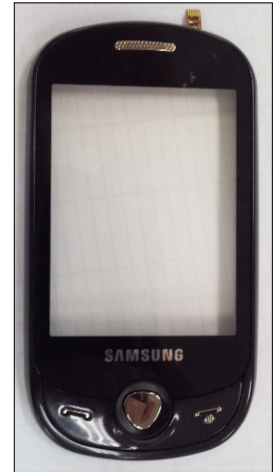
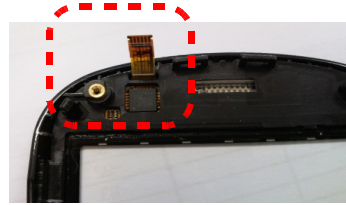
5

1) Assemble the Antenna to PBA



6

1) Attach the TSP.
2) Assemble the keypad



※ **Caution**

1) Be careful not to make Antenna hook damage.

※ **Caution**

1) Be careful not to damage the motor wire .

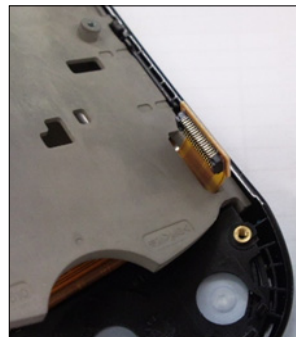
7

1) Attach and assemble the LCD



8

1) Assemble the bracket.



※ **Caution**

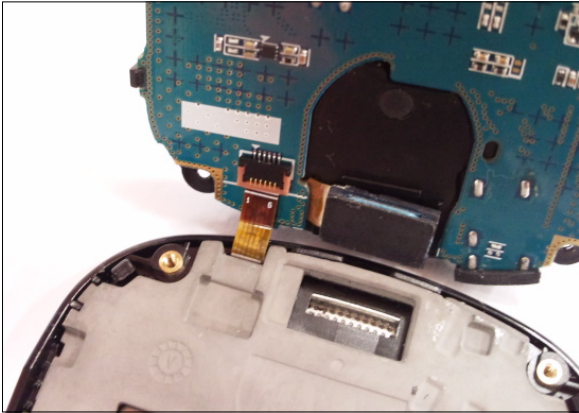
1) Be careful not to damage LCD.

※ **Caution**

1) Be careful not to damage to LCD connector.

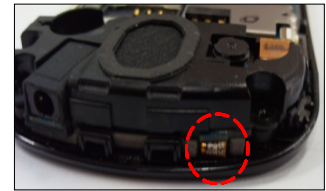
9

1) Assemble TSP FPCB to PBA connector.



10

1) Locate and make sure of assembly hooks after placing PBA on the top.
2) Assemble LCD connector



※ **Caution**

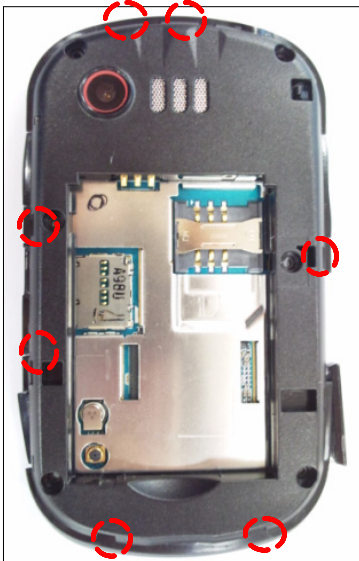
1) Be careful not to damage TSP FPCB.

※ **Caution**

1) Be careful not to make scratch and molding damage.
2) Be careful not to damage TSP FPCB.

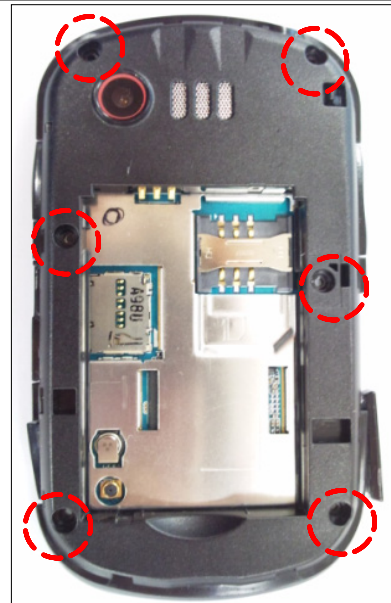
11

1) Confirm assembly hooks after assembling the rear case.



12

1) Screw at 6 points



※ **Caution**

1) Be careful not to make scratch and molding damage.

※ **Caution**

1) Be careful not to make scratch and molding damage.

6. MAIN Electrical Parts List

SEC CODE	DESIGN LOC	DESCRIPTION
0403-001547	ZD301	DIODE-ZENER
0406-001286	ZD405	DIODE-TVS
0406-001286	ZD406	DIODE-TVS
0406-001293	ZD400	DIODE-TVS
0406-001293	ZD402	DIODE-TVS
0406-001293	ZD500	DIODE-TVS
0406-001293	ZD501	DIODE-TVS
0406-001293	ZD502	DIODE-TVS
0406-001293	ZD503	DIODE-TVS
0406-001329	D400	DIODE-TVS
0406-001361	ZD300	DIODE-TVS
0505-001325	Q400	FET-SILICON
1003-002047	U400	IC-MOTOR DRIVER
1108-000297	UME200	IC-MCP
1201-002933	PAM100	IC-POWER AMP
1203-005728	U302	IC-POWER SUPERVISOR
1203-005770	U300	IC-MULTI REG
1203-006077	U301	IC-BACKLIGHT DRIVER
1205-003310	U103	IC-TRANSCEIVER
1205-003874	UCP200	IC-MODEM
1205-003883	U100	IC-BLUETOOTH
1404-001221	VR200	THERMISTOR-NTC
2007-000140	R207	R-CHIP
2007-000141	R303	R-CHIP
2007-000141	R401	R-CHIP
2007-000141	R409	R-CHIP
2007-000141	R416	R-CHIP
2007-000141	R420	R-CHIP
2007-000143	R309	R-CHIP
2007-000143	R402	R-CHIP
2007-000143	R417	R-CHIP
2007-000148	R104	R-CHIP
2007-000148	R105	R-CHIP
2007-000148	R315	R-CHIP
2007-000149	R206	R-CHIP
2007-000149	R314	R-CHIP
2007-000152	R318	R-CHIP

SEC CODE	DESIGN LOC	DESCRIPTION
2007-000152	R319	R-CHIP
2007-000152	R427	R-CHIP
2007-000157	R107	R-CHIP
2007-000157	R108	R-CHIP
2007-000157	R313	R-CHIP
2007-000159	R310	R-CHIP
2007-000159	R311	R-CHIP
2007-000159	R312	R-CHIP
2007-000159	R316	R-CHIP
2007-000160	R100	R-CHIP
2007-000160	R200	R-CHIP
2007-000165	R425	R-CHIP
2007-000166	R317	R-CHIP
2007-000170	R407	R-CHIP
2007-000170	R415	R-CHIP
2007-000170	R426	R-CHIP
2007-000173	R320	R-CHIP
2007-000566	R201	R-CHIP
2007-001292	R300	R-CHIP
2007-001292	R301	R-CHIP
2007-001319	R202	R-CHIP
2007-001319	R203	R-CHIP
2007-001319	R204	R-CHIP
2007-001319	U401	R-CHIP
2007-001333	R304	R-CHIP
2007-001333	R306	R-CHIP
2007-001333	R429	R-CHIP
2007-001333	R440	R-CHIP
2007-001339	R307	R-CHIP
2007-002970	R102	R-CHIP
2007-002970	R103	R-CHIP
2007-007573	R302	R-CHIP
2007-007875	R308	R-CHIP
2007-008354	R305	R-CHIP
2203-000233	C106	C-CER,CHIP
2203-000233	C400	C-CER,CHIP
2203-000233	C509	C-CER,CHIP

SEC CODE	DESIGN LOC	DESCRIPTION
2203-000254	C108	C-CER,CHIP
2203-000254	C111	C-CER,CHIP
2203-000254	C203	C-CER,CHIP
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2203-000386	C335	C-CER,CHIP
2203-000386	C338	C-CER,CHIP
2203-000386	C401	C-CER,CHIP
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2203-000438	C437	C-CER,CHIP
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2203-000585	C428	C-CER,CHIP
2203-000585	C433	C-CER,CHIP
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2203-000679	C117	C-CER,CHIP
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2203-000812	C148	C-CER,CHIP
2203-000854	C348	C-CER,CHIP
2203-000854	C349	C-CER,CHIP
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2203-005050	C114	C-CER,CHIP
2203-005053	C121	C-CER,CHIP
2203-005234	C147	C-CER,CHIP
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2203-005288	C101	C-CER,CHIP

SEC CODE	DESIGN LOC	DESCRIPTION
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2203-006201	C307	C-CER,CHIP
2203-006257	C113	C-CER,CHIP
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2203-006348	C301	C-CER,CHIP

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2203-006872	C112	C-CER,CHIP
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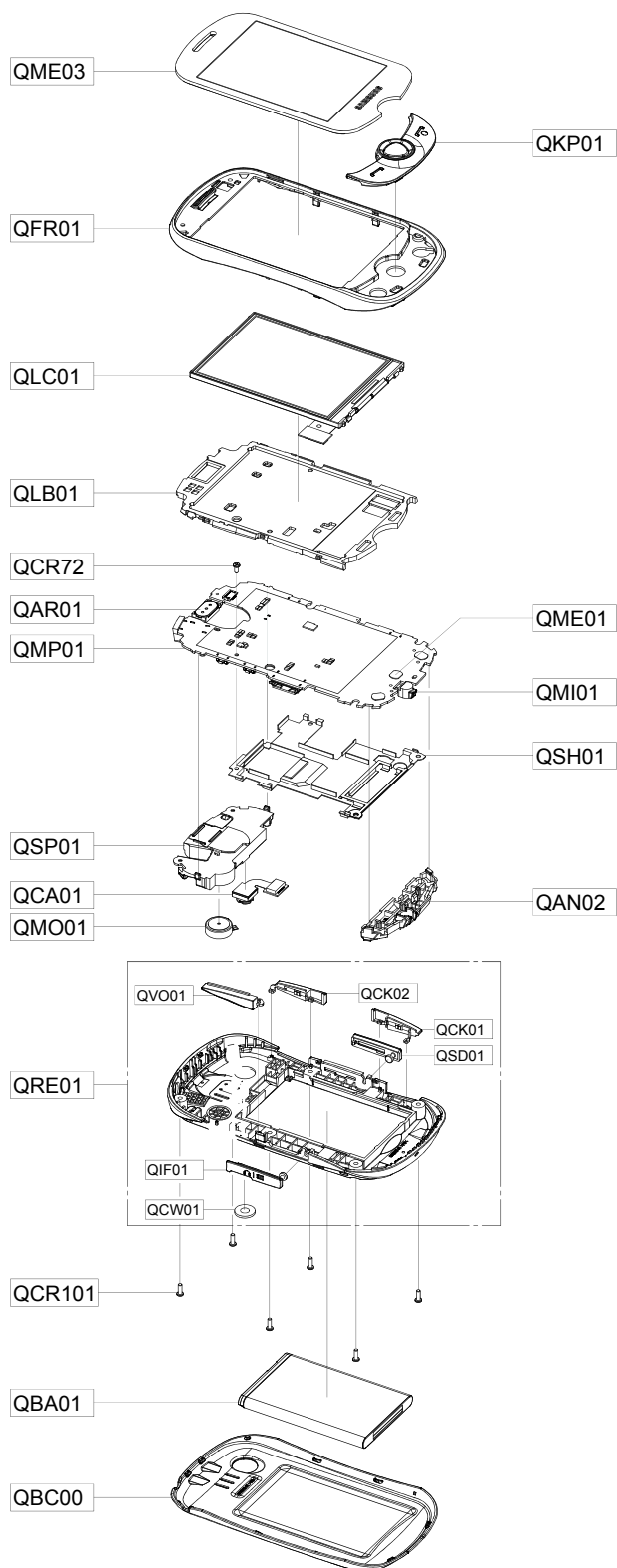
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2203-007279	C352	C-CER,CHIP
2203-007279	C418	C-CER,CHIP
2203-007317	C345	C-CER,CHIP
2203-007425	C337	C-CER,CHIP
2203-007425	C439	C-CER,CHIP
2404-001377	C319	C-TA,CHIP
2404-001377	TA400	C-TA,CHIP
2404-001496	TA300	C-TA,CHIP
2409-001172	BAT300	C-ETC
2703-002170	L110	INDUCTOR-SMD
2703-002170	L113	INDUCTOR-SMD
2703-002202	L111	INDUCTOR-SMD
2703-002202	L112	INDUCTOR-SMD
2703-002202	L115	INDUCTOR-SMD
2703-002203	L109	INDUCTOR-SMD
2703-002207	L102	INDUCTOR-SMD
2703-002207	L120	INDUCTOR-SMD
2703-002208	L116	INDUCTOR-SMD
2703-002208	L121	INDUCTOR-SMD
2703-002268	L101	INDUCTOR-SMD
2703-002268	L103	INDUCTOR-SMD
2703-002269	L100	INDUCTOR-SMD
2703-002313	L106	INDUCTOR-SMD
2703-002313	L107	INDUCTOR-SMD
2703-002313	L406	INDUCTOR-SMD
2703-002313	L407	INDUCTOR-SMD
2703-002368	L118	INDUCTOR-SMD
2703-003121	L412	INDUCTOR-SMD
2703-003260	L300	INDUCTOR-SMD
2703-003476	L400	INDUCTOR-SMD
2801-004339	OSC300	CRYSTAL-SMD
2801-004893	OSC100	CRYSTAL-SMD
2901-001576	F500	FILTER-EMI/ESD

SEC CODE	DESIGN LOC	DESCRIPTION
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2901-001576	F502	FILTER-EMI/ESD
2901-001576	F503	FILTER-EMI/ESD
2901-001576	F504	FILTER-EMI/ESD
2904-001889	F102	FILTER-SAW
2904-001920	F101	FILTER-SAW
2909-001312	F100	FILTER-LC
3301-001659	L415	BEAD-SMD
3301-001659	L416	BEAD-SMD
3301-001659	L419	BEAD-SMD
3301-001659	L420	BEAD-SMD
3301-001729	L401	BEAD-SMD
3301-001729	L402	BEAD-SMD
3301-001729	L421	BEAD-SMD
3301-001729	L422	BEAD-SMD
3404-001152	TAC_CAM	SWITCH-TACT
3404-001152	TAC_DN	SWITCH-TACT
3404-001152	TAC_HOLD	SWITCH-TACT
3404-001152	TAC_UP	SWITCH-TACT
3705-001503	RFS100	CONNECTOR-COAXIAL
3708-002015	HDC500	CONNECTOR-FPC/FFC/PIC
3709-001447	SIM300	CONNECTOR-CARD EDGE
3709-001575	CD300	CONNECTOR-CARD EDGE
3710-002683	IFC400	SOCKET-INTERFACE
3711-005296	HDC503	HEADER-BOARD TO BOARD
3711-005793	HDC501	HEADER-BOARD TO BOARD
3711-006808	BTC300	HEADER-BATTERY
3722-003003	EAR400	JACK-EAR PHONE
4202-001463	ANT102	ANTENNA-CHIP
GH70-04132A	SC100	ICT SHIELD-CAN CLIP
GH80-03320A	R109	SHORT PAD
GH80-03320A	R208	SHORT PAD
GH80-03320A	R428	SHORT PAD

Please consult the GSPN website (Samsung Portal) for the most recent version of the product's part list.

5. Exploded View and Parts List

5-1. Cellular phone Exploded View



- This Document can not be used without Samsung's authorization -

5-2. Cellular phone Parts list : GT-C3510CWAXEF

Design LOC	Description	SEC CODE
QAN02	ANTENNA-MAIN (GT-C3510)	GH42-02300A
QAR01	AUDIO-RECEIVER	3009-001428
QBA01	INNER BATTERY PACK-AB463651BU,960MAH	GH43-03216A
QBC00	ASSY COVER-BATT V3(OPTION)	GH98-16285D
QCA01	CAMERA MODULE-GT-C3510	GH59-08802A
QCK01	ASSY KEY-CAM	GH98-16235D
QCK02	ASSY KEY-HOLD	GH98-16234D
QCR101	SCREW-MACHINE	6001-002005
QCR72	SCREW-MACHINE	6001-002051
QCW01	PCT WINDOW-CAMERA	GH72-56746A
QFR01	ASSY CASE-FRONT	GH98-15114D
QIF01	ASSY CASE-IF	GH98-16231D
QKP01	ASSY KEYPAD-(OPEN/WHITE)	GH98-15117D
QLB01	ASSY BRACKET-LCD	GH98-15118A
QLC01	ASSY LCD-2.8",TFT(GT-C3510)	GH96-04335A
QME01	DOVE SHEET-GT-C3510(MAIN)	GH59-08590A
QME03	TOUCH/PANEL-GT-C3510(WHT)	GH59-08654B
QMI01	MICROPHONE-ASSY-GT-C3510	GH30-00627A
QMO01	MOTOR LINEAR VIBRATION-GT_S7330	GH31-00449A
QMP01	A/S ASSY-PBA MAIN,ECC,GH-C3510(SVC)	GH82-04359A
QRE01	ASSY CASE-REAR	GH98-15116D
QSD01	ASSY CASE-SD	GH98-16232D
QSP01	MODULE-SPKARRIER ASSY(GT-C3510)	GH59-08765A
QVO01	ASSY KEY-VOL	GH98-16233D

2. Specification

2-1. GSM General Specification

	GSM850	GSM900	DCS1800	PCS1900
Freq. Band[MHz] Uplink/Downlink	824~849 869~894	880~915 925~960	1710~1785 1805~1880	1850~1910 1930~1990
ARFCN range	128~251	0~124 & 975~1023	512~885	512~810
Tx/Rx spacing	45MHz	45MHz	95MHz	80MHz
Mod. Bit rate/ Bit Period	270.833kbps 3.692us	270.833kbps 3.692us	270.833kbps 3.692us	270.833kbps 3.692us
Time Slot Period/Frame Period	576.9us 4.615ms	576.9us 4.615ms	576.9us 4.615ms	576.9us 4.615ms
Modulation	0.3GMSK	0.3GMSK	0.3GMSK	0.3GMSK
MS Power	33dBm~5dBm	33dBm~5dBm	30dBm~0dBm	30dBm~0dBm
Power Class	⁴ (max +33dBm)	⁴ (max +33dBm)	¹ (max +30dBm)	¹ (max +30dBm)
Sensitivity	-102dBm	-102dBm	-100dBm	-100dBm
TDMA Mux	8	8	8	8
Cell Radius	35Km	35Km	2Km	2Km

2-2. GSM Tx Power Class

TX Power control level	GSM850 GSM900	TX Power control level	DCS1800	TX Power control level	PCS1900
5	33±3 dBm	0	30±3 dBm	0	30±3 dBm
6	31±3 dBm	1	28±3 dBm	1	28±3 dBm
7	29±3 dBm	2	26±3 dBm	2	26±3 dBm
8	27±3 dBm	3	24±3 dBm	3	24±3 dBm
9	25±3 dBm	4	22±3 dBm	4	22±3 dBm
10	23±3 dBm	5	20±3 dBm	5	20±3 dBm
11	21±3 dBm	6	18±3 dBm	6	18±3 dBm
12	19±3 dBm	7	16±3 dBm	7	16±3 dBm
13	17±3 dBm	8	14±3 dBm	8	14±3 dBm
14	15±3 dBm	9	12±4 dBm	9	12±4 dBm
15	13±3 dBm	10	10±4 dBm	10	10±4 dBm
16	11±5 dBm	11	8±4dBm	11	8±4dBm
17	9±5 dBm	12	6±4 dBm	12	6±4 dBm
18	7±5 dBm	13	4±4 dBm	13	4±4 dBm
19	5±5 dBm	14	2±5 dBm	14	2±5 dBm
		15	0±5 dBm	15	0±5 dBm

2-3. GSM EDGE TX power class

Only in Master

TX Power control level	GSM900 GSM850	TX Power control level	DCS1800	TX Power control level	PCS1900
8	27±3 dBm	2	26±3 dBm	2	26±3 dBm
9	25±3 dBm	3	24±3 dBm	3	24±3 dBm
10	23±3 dBm	4	22±3 dBm	4	22±3 dBm
11	21±3 dBm	5	20±3 dBm	5	20±3 dBm
12	19±3 dBm	6	18±3 dBm	6	18±3 dBm
13	17±3 dBm	7	16±3 dBm	7	16±3 dBm
14	15±3 dBm	8	12±3 dBm	8	12±3 dBm
15	13±3 dBm	9	10±3 dBm	9	10±3 dBm
16	11±5 dBm	10	14±3 dBm	10	14±3 dBm
17	9±5 dBm	11	12±4 dBm	11	12±4 dBm
18	7±5 dBm	12	10±4 dBm	12	10±4 dBm
19	5±5 dBm	13	8±4dBm	13	8±4dBm
		14	6±4 dBm	14	6±4 dBm
		15	4±4 dBm	15	4±4 dBm

3. Operation Instruction and Installation

Main Function

- 1.3 Mega Pixel Camera
- QVGA 2.8 inch TSP
- SMS/MMS/EMS (OMA v1.2)
- WAP 2.0 Browser
- MP3/AMR/AAC/AAC+/e-AAC+/WMA/i-melody
- Quad Band(EGSM900/DCS,PCS,EDGE)
- MicroSD Card Support
- External Memory
- USB v2.0 High-speed, Bluetooth v2.1
- FM Radio Support, Radio Data System

4. Array course control

4-1. Software Adjustments



Test Jig (GH99-36900A)



Test Cable (GH39-01313A)



RF Test Cable (GH39-00985A)



Adapter (GH99-38251A)

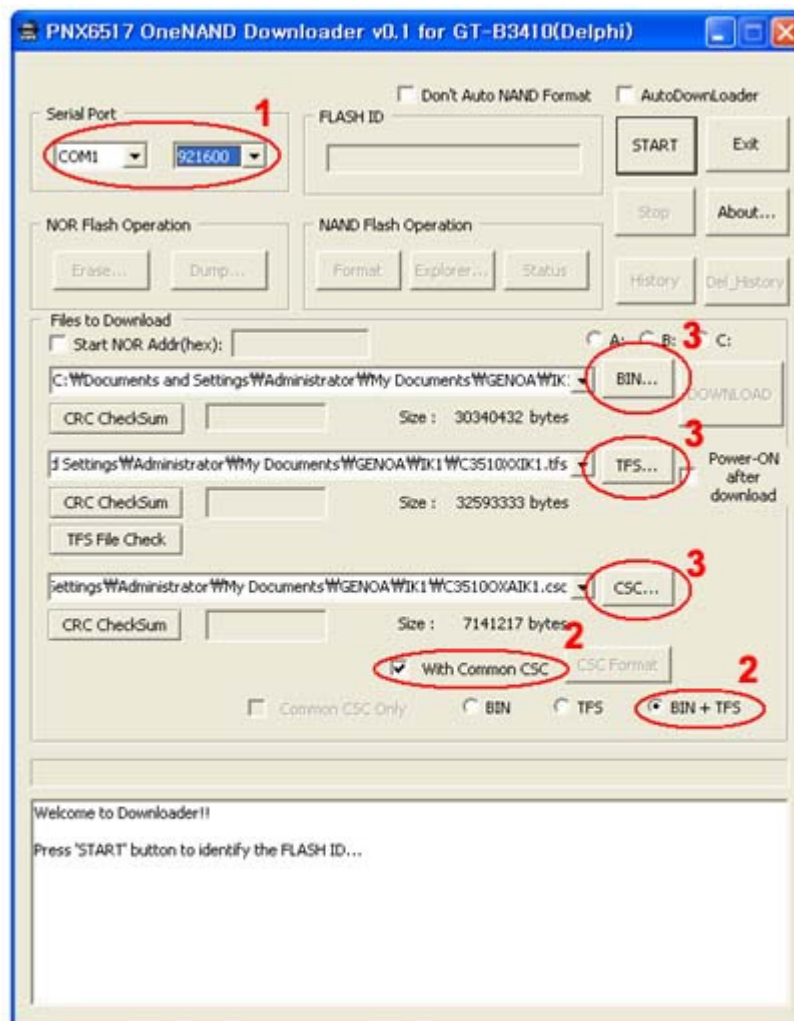
4-2. Software Downloading

4-2-1. Pre-requisite for Downloading

- Downloader Program([PNX6517 OneNAND Downloader v0.1 for GT-B3410\(Delphi\)](#))
- GT-C3510 Mobile Phone
- Data Cable
- Binary file, TFS file, CSC file

4-2-2. S/W Downloader Program

- the binary download program by executing the
["PNX6517 OneNAND Downloader v0.1 for GT-B3410\(Delphi\).exe"](#)

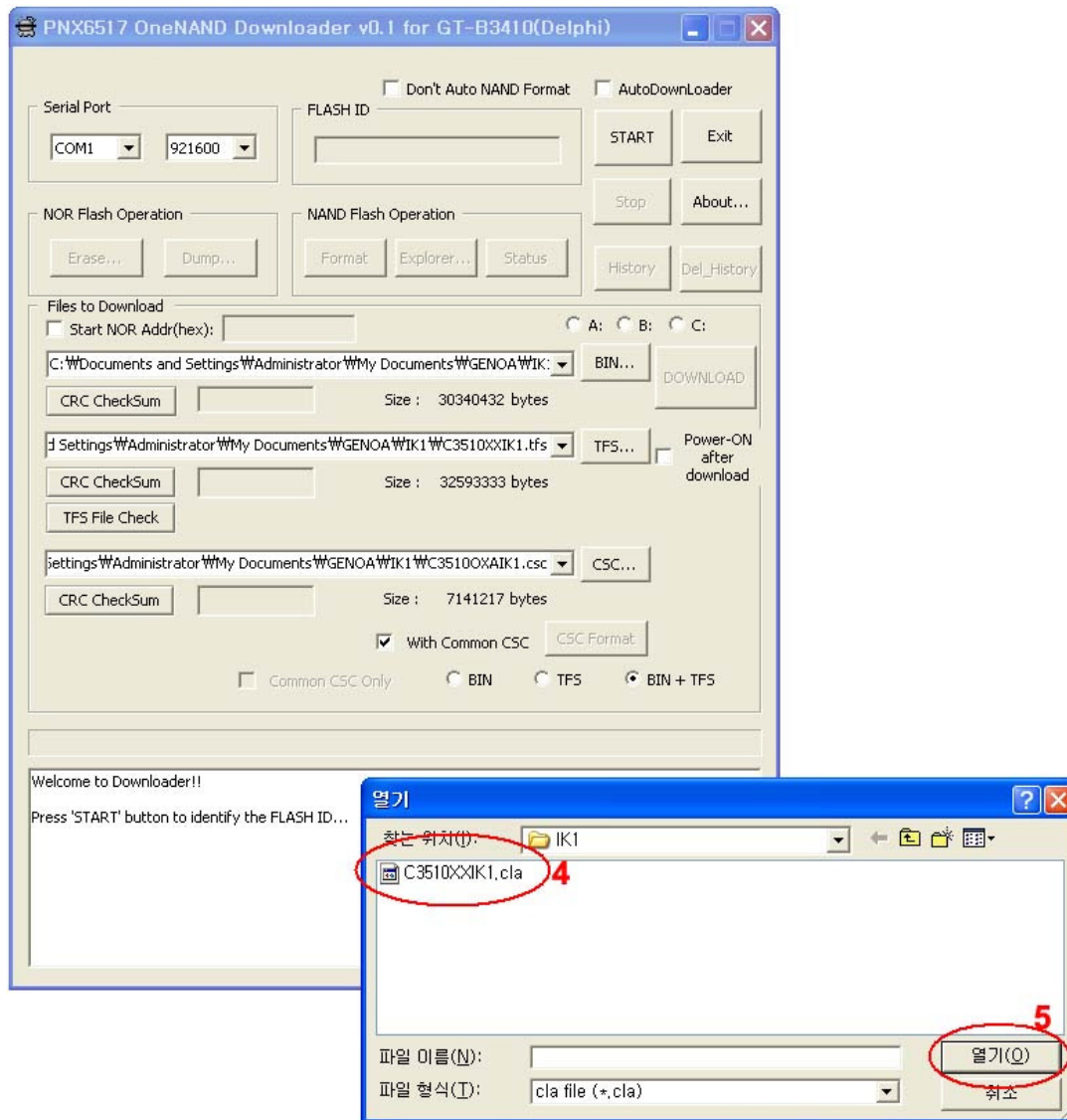


1. Select the connected serial port and the rate of speed.
2. Select the check box, the mode you want to download.
 - if only binary file update is needed, check "BIN"
 - if only tfs file update is needed, check "TFS"

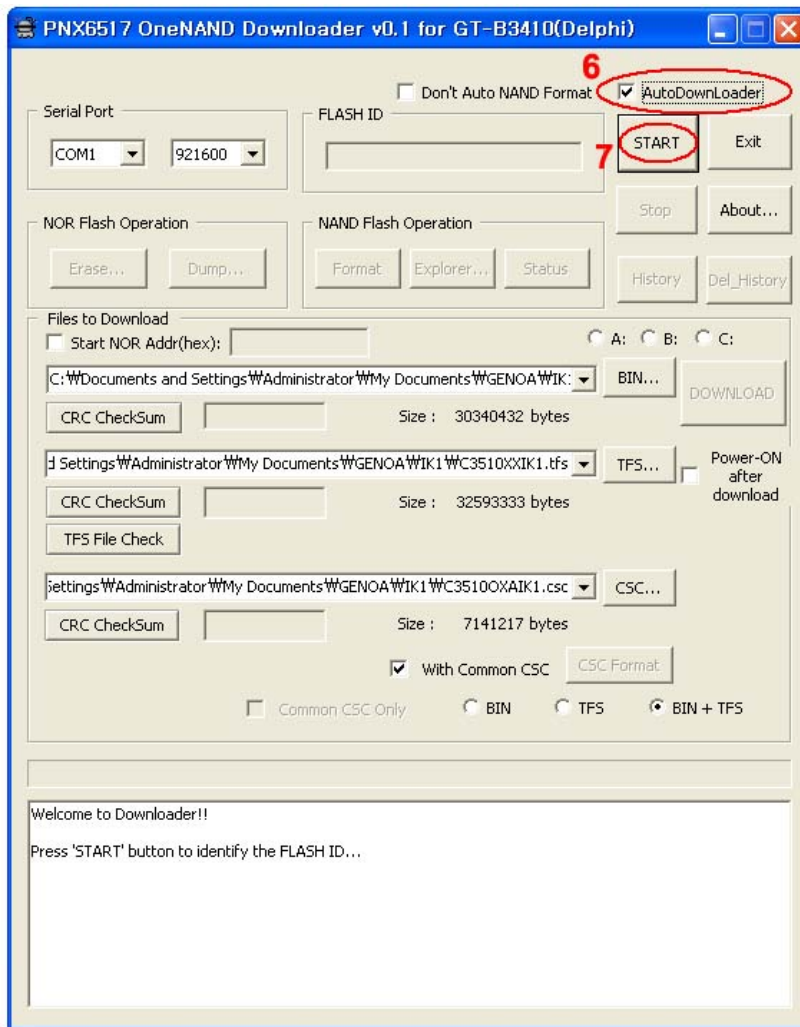
- if only csc file update is needed, check "Common CSC ONLY"
- if all file updates are needed, check both "BIN+TFS" and "with Common CSC"

3. Click the corresponding button to select the file(s) that you want to download.

4/5. Choose each binary/tfs/csc file, then click open button.



6/7. After all necessary binary/tfs/csc file(s) are selected, check "AutoDownLoader" and click "START" button. Then, connect a phone with test cable at the designated serial port. If connection is successful, the downloader will start with pre-downloading and continue to main downloading.



4-3. Memory Full Reset

After download has completed, follow the below procedure for full memory reset.

Full Reset :

***2767*3855#**

10. Reference data

Reference Abbreviate

- **AAC**: Advanced Audio Coding.
- **AVC** : Advanced Video Coding.
- **BER** : Bit Error Rate
- **BPSK**: Binary Phase Shift Keying
- **CA** : Conditional Access
- **CDM** : Code Division Multiplexing
- **C/I** : Carrier to Interference
- **DMB** : Digital Multimedia Broadcasting
- **EN** : European Standard
- **ES** : Elementary Stream
- **ETSI**: European Telecommunications Standards Institute
- **MPEG**: Moving Picture Experts Group
- **PN** : Pseudo-random Noise
- **PS** : Pilot Symbol
- **QPSK**: Quadrature Phase Shift Keying
- **RS** : Reed-Solomon
- **SI** : Service Information
- **TDM** : Time Division Multiplexing
- **TS** : Transport Stream

1. Safety Precautions

1-1. Repair Precaution

- Repair in Shield Box, during detailed tuning. Take specially care of tuning or test, because specipicty of cellular phone is sensitive for surrounding interference(RF noise).
- Be careful to use a kind of magnetic object or tool, because performance of parts is damaged by the influence of magnetic force.
- Surely use a standard screwdriver when you disassemble this product, otherwise screw will be worn away.
- Use a thicken twisted wire when you measure level.
A thicken twisted wire has low resistance, therefore error of measurement is few.
- Repair after separate Test Pack and Set because for short danger (for example an overcurrent and furious flames of parts etc) when you repair board in condition of connecting Test Pack and tuning on.
- Take specially care of soldering, because Land of PCB is small and weak in heat.
- Surely tune on/off while using AC power plug, because a repair of battery charger is dangerous when tuning ON/OFF PBA and Connector after disassembling charger.
- Don't use as you pleases after change other material than replacement registered on SEC System. Otherwise engineer in charge isn't charged with problem that you don't keep this rules.

1-2. ESD(Electrostatically Sensitive Devices) Precaution

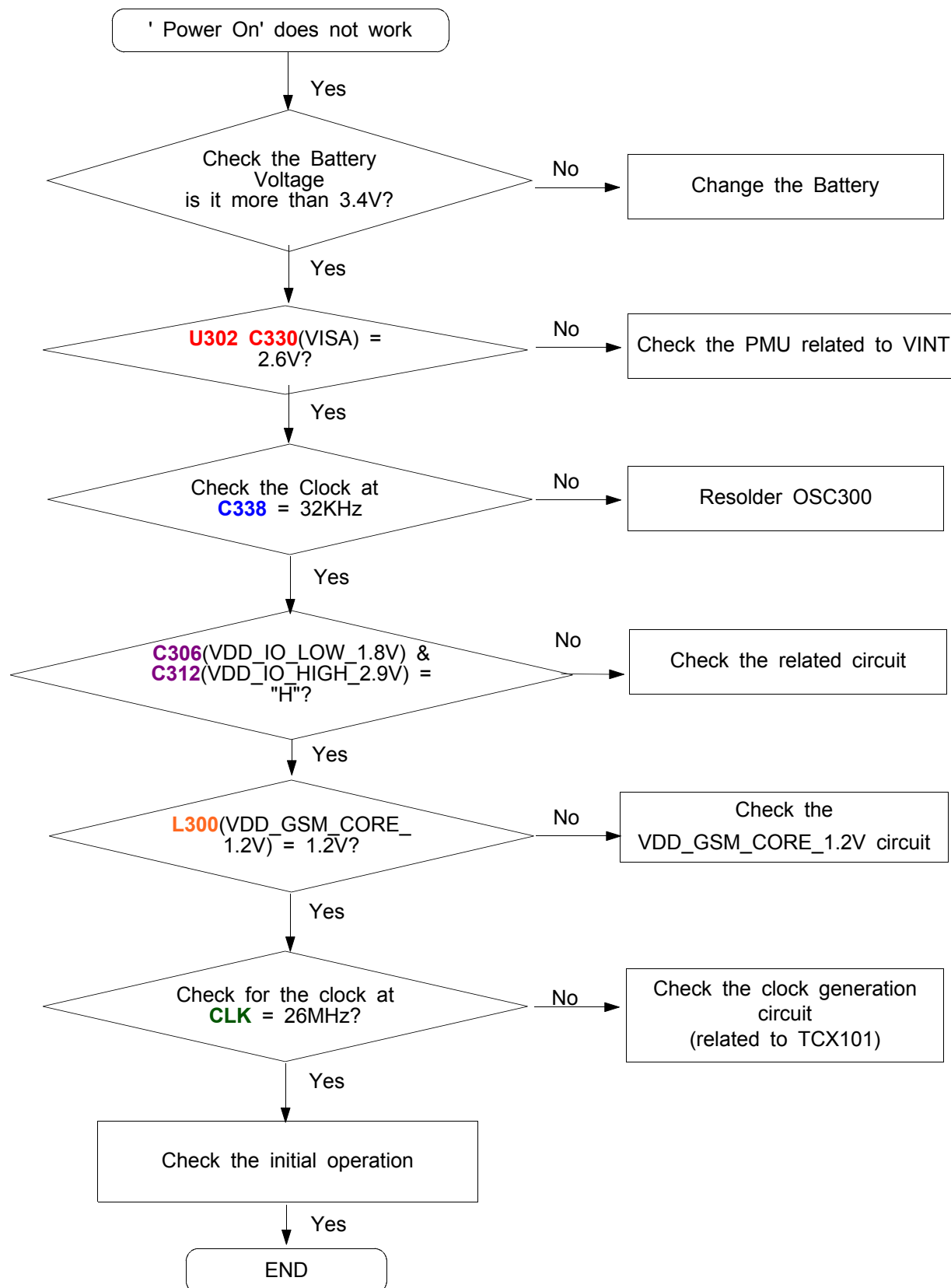
Several semiconductor may be damaged easily by static electricity. Such parts are called by ESD (Electrostatically Sensitive Devices), for example IC,BGA chip etc. Read Precaution below.

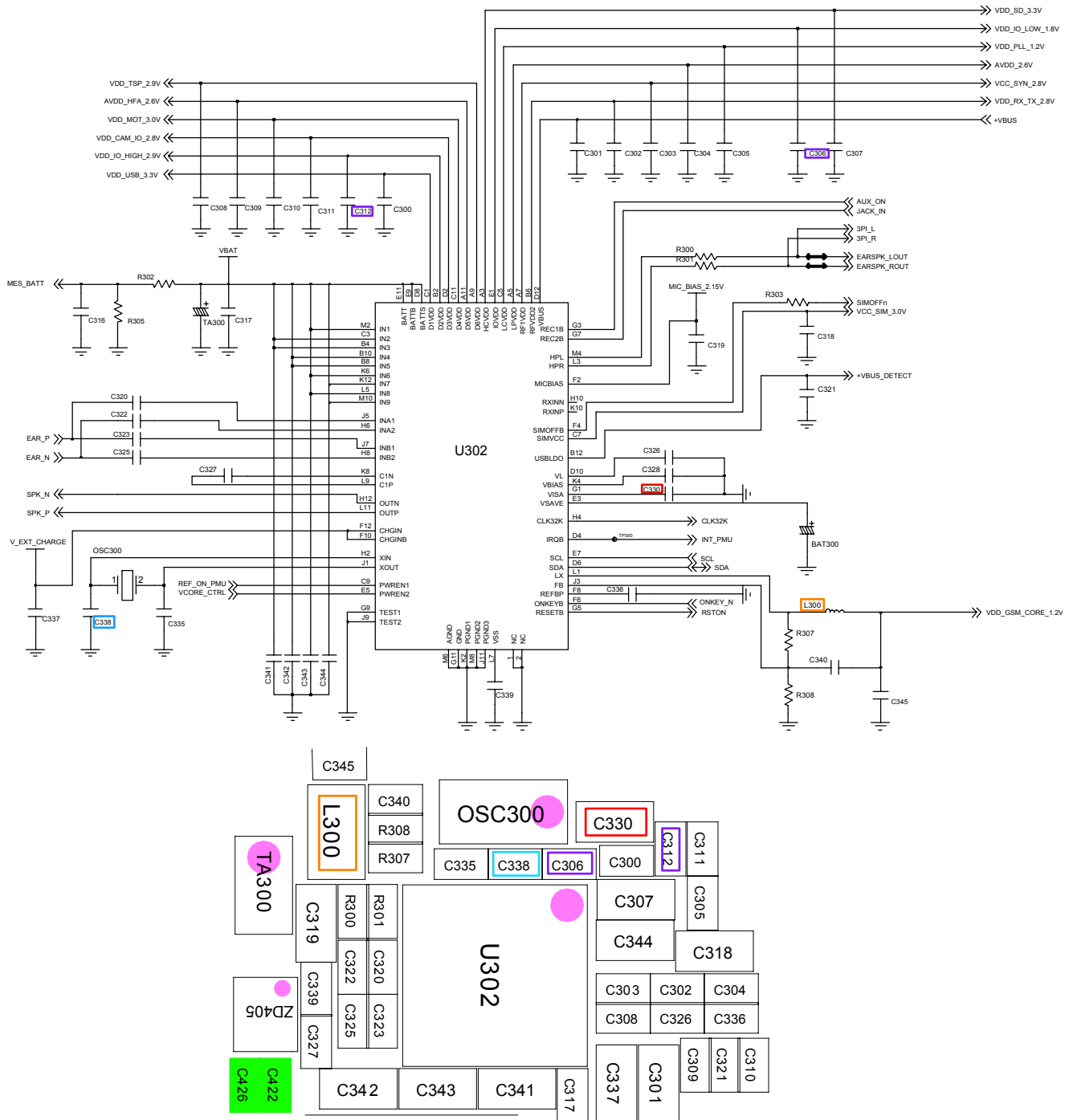
You can prevent from ESD damage by static electricity.

- Remove static electricity remained your body before you touch semiconductor or parts with semiconductor. There are ways that you touch an earthed place or wear static electricity prevention string on wrist.
- Use earthed soldering steel when you connect or disconnect ESD.
- Use soldering removing tool to break static electricity. , otherwise ESD will be damaged by static electricity.
- Don't unpack until you set up ESD on product. Because most of ESD are packed by box and aluminum plate to have conductive power,they are prevented from static electricity.
- You must maintain electric contact between ESD and place due to be set up until ESD is connected completely to the proper place or a circuit board.

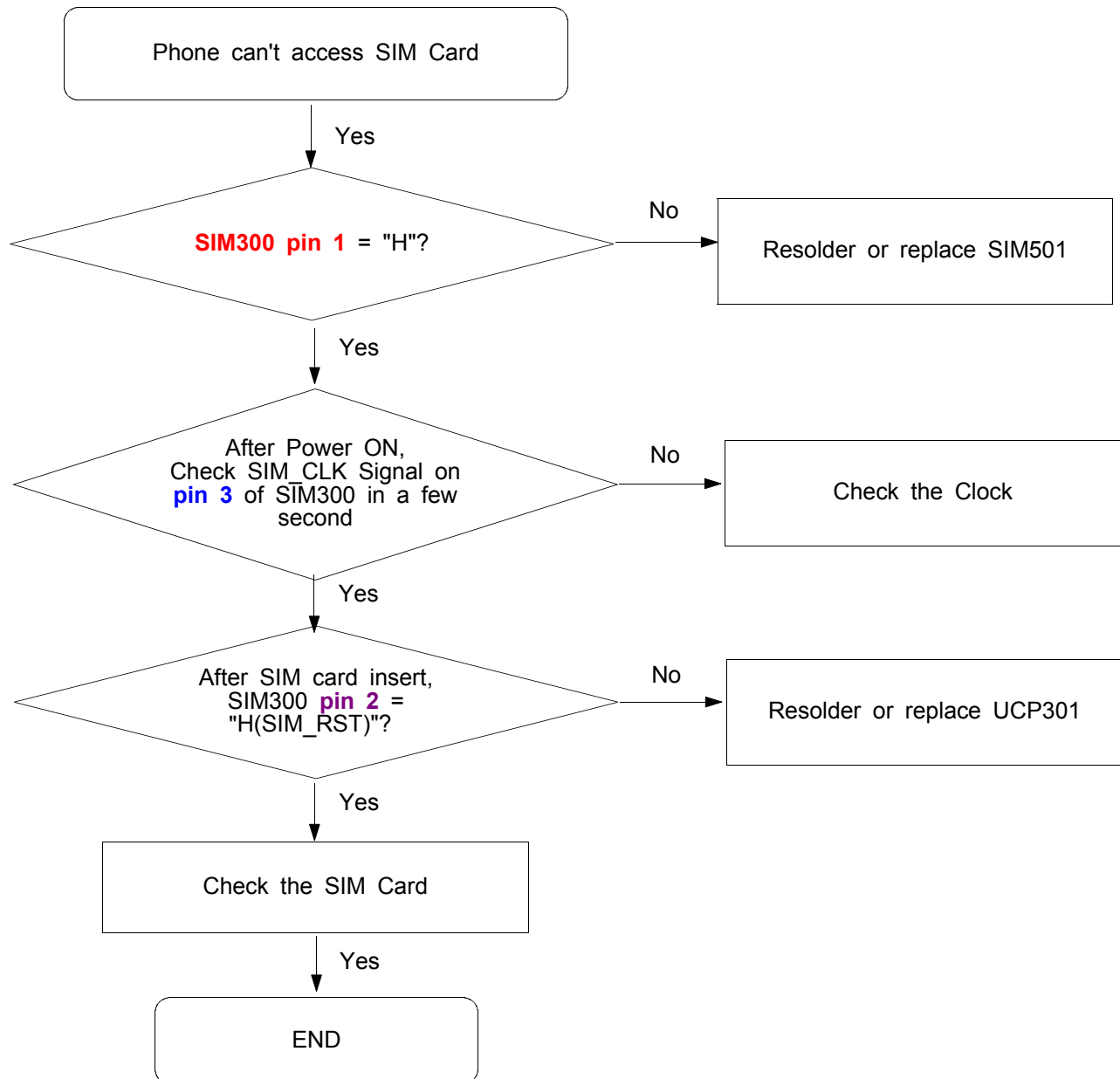
9. Flow Chart of Troubleshooting

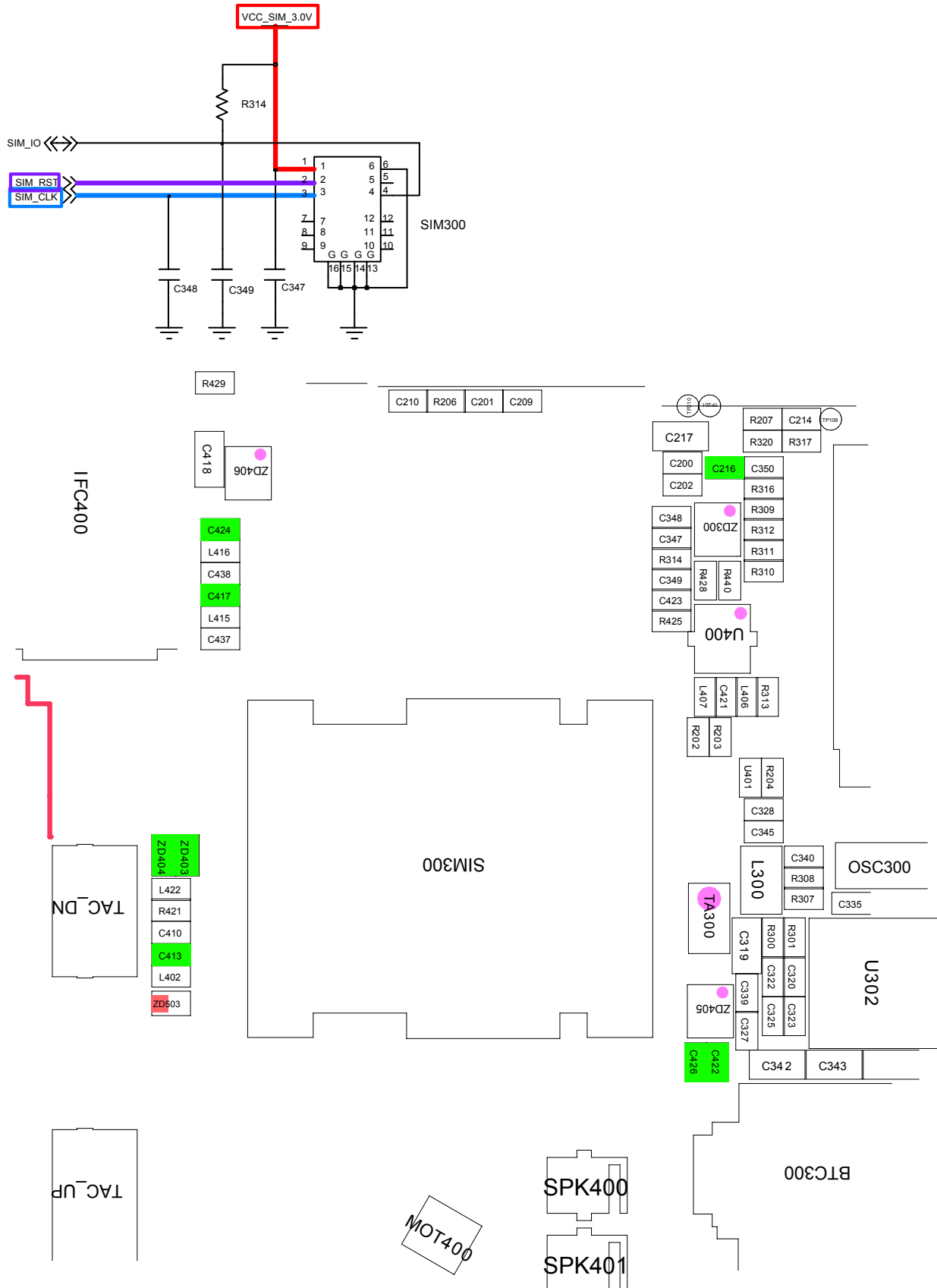
9-1.Baseband
9-1-1Power ON



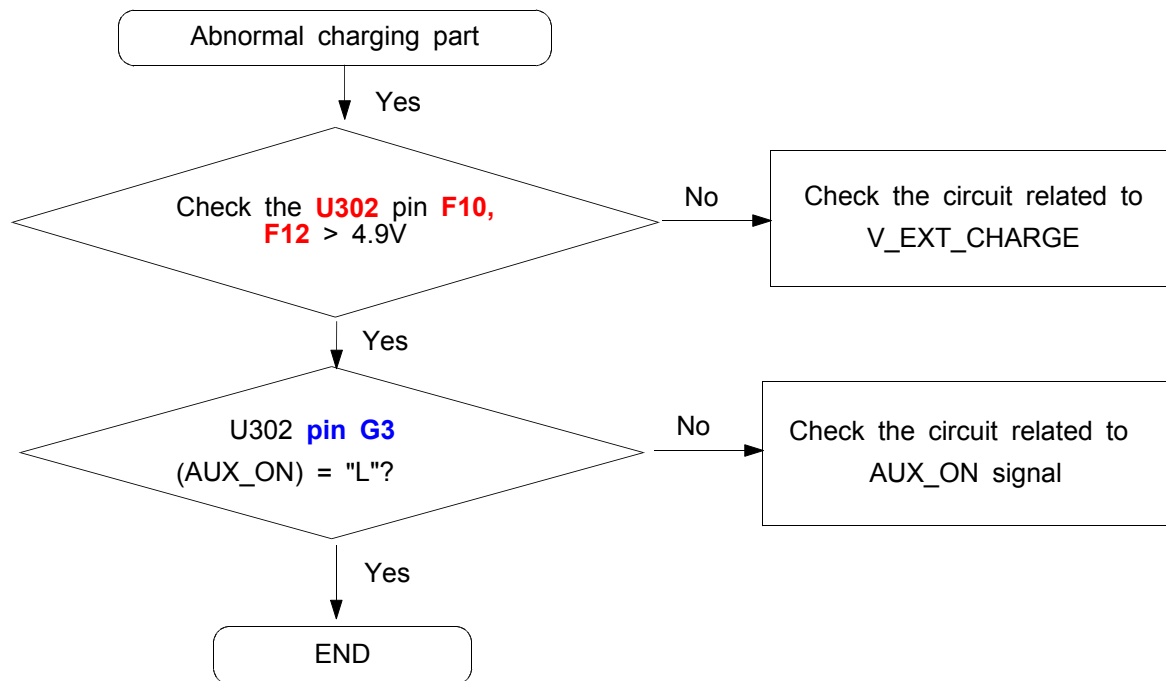


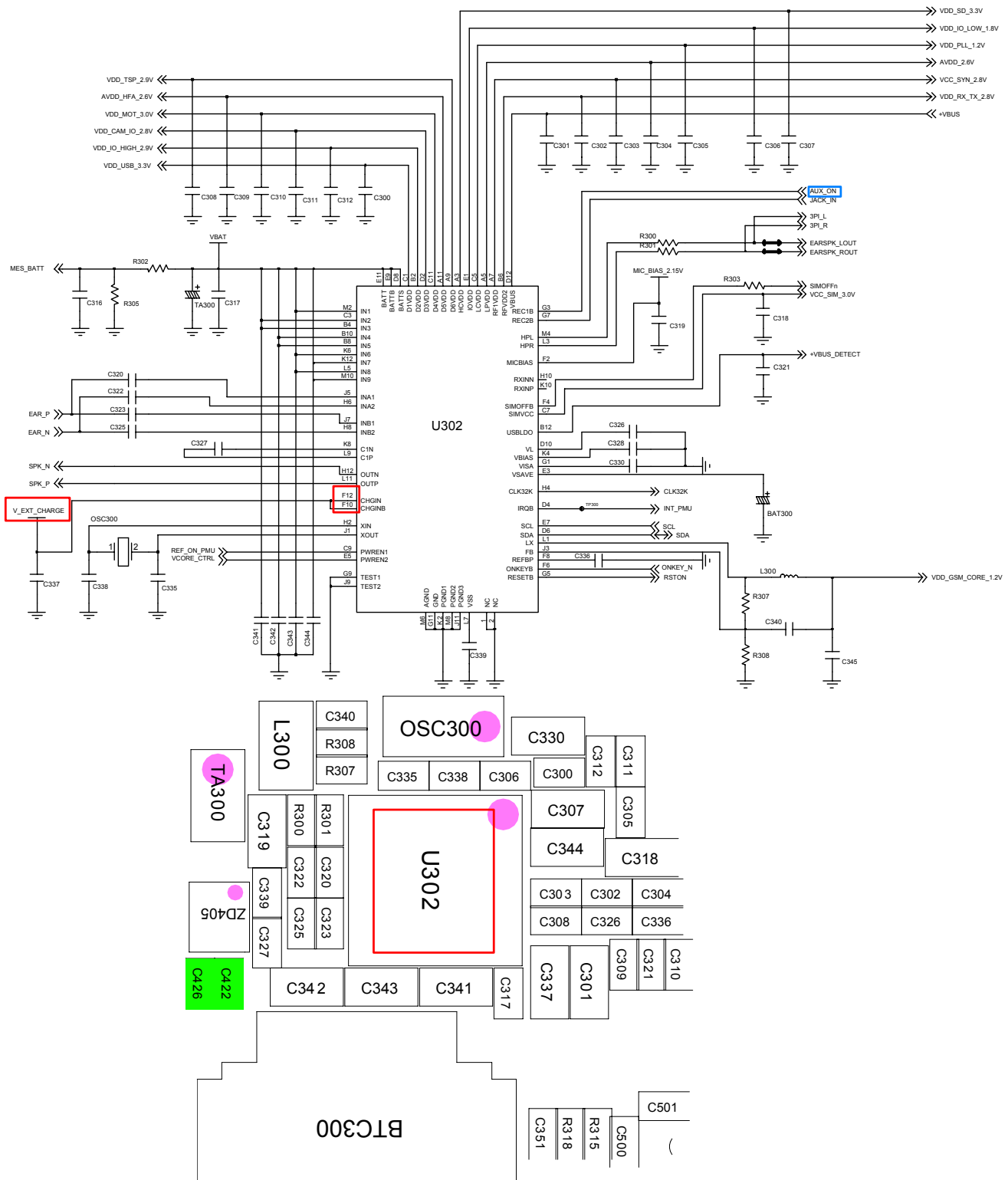
9-1-3. SIM Part



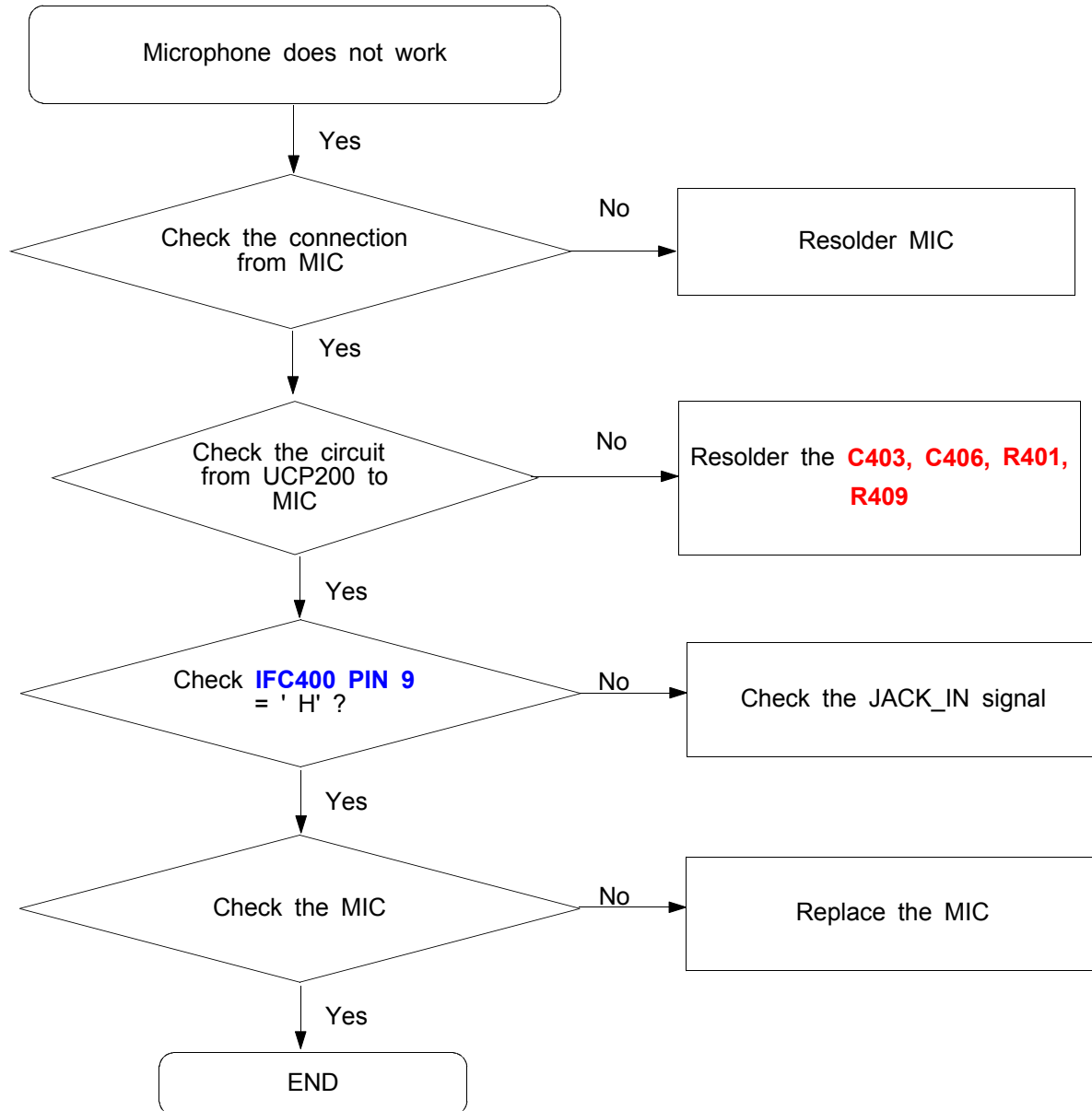


9-1-4. Charging Part



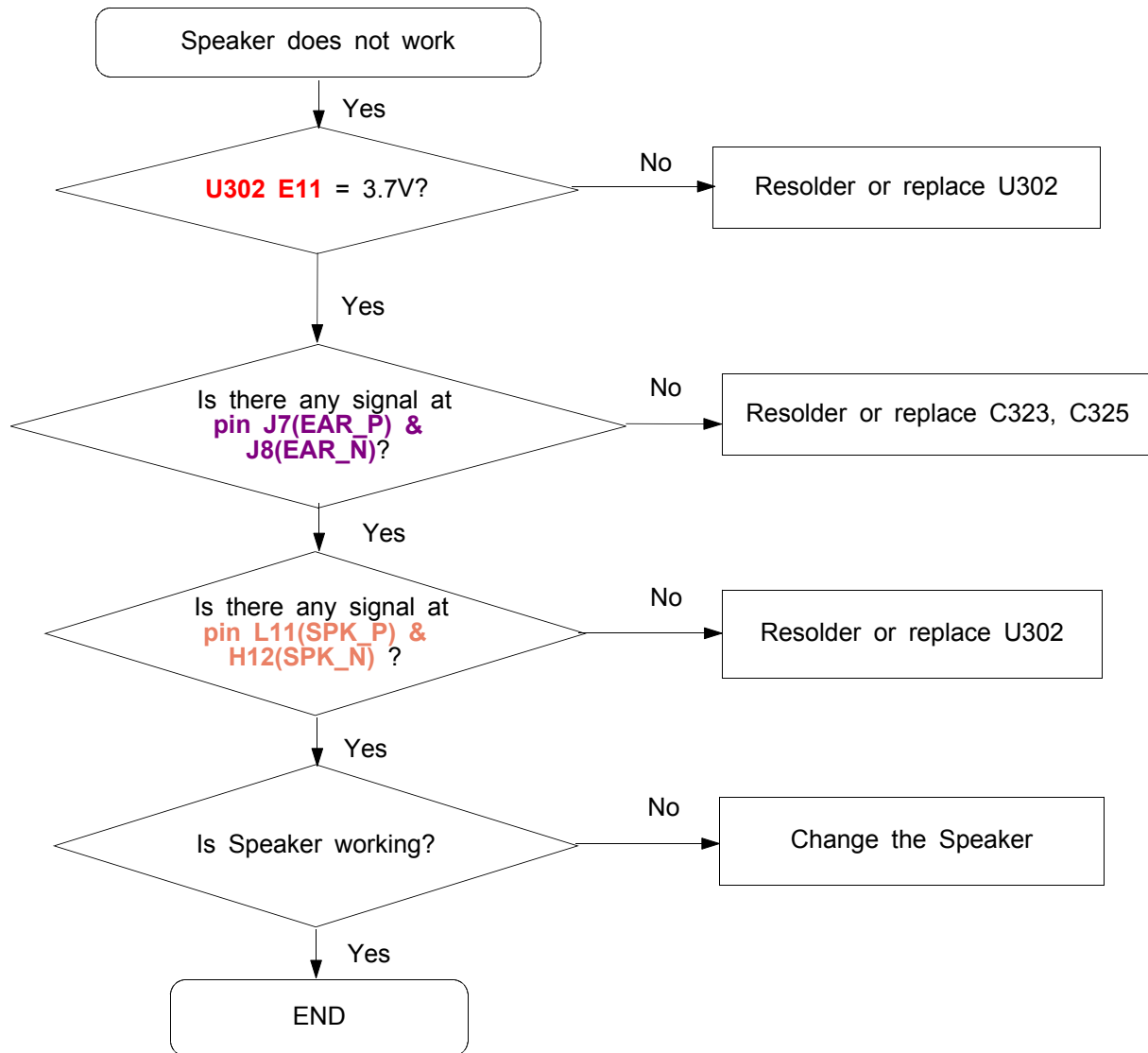


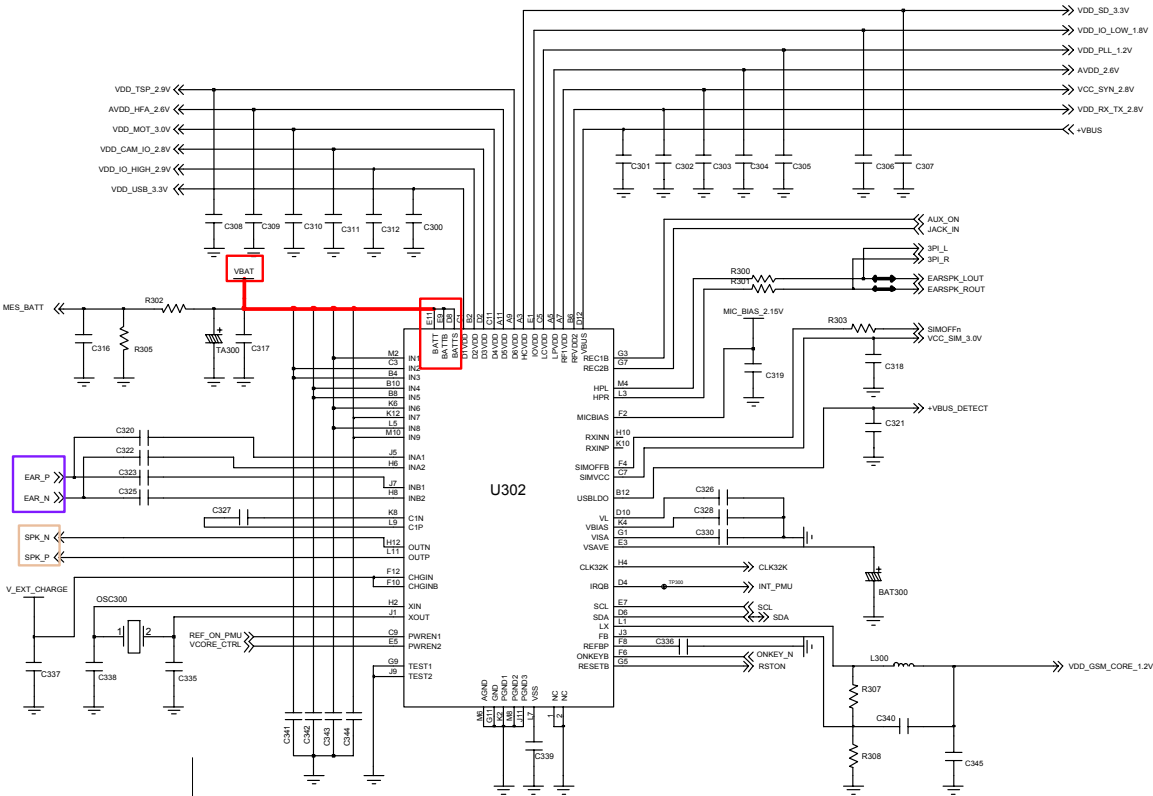
9-1-5. Microphone Part



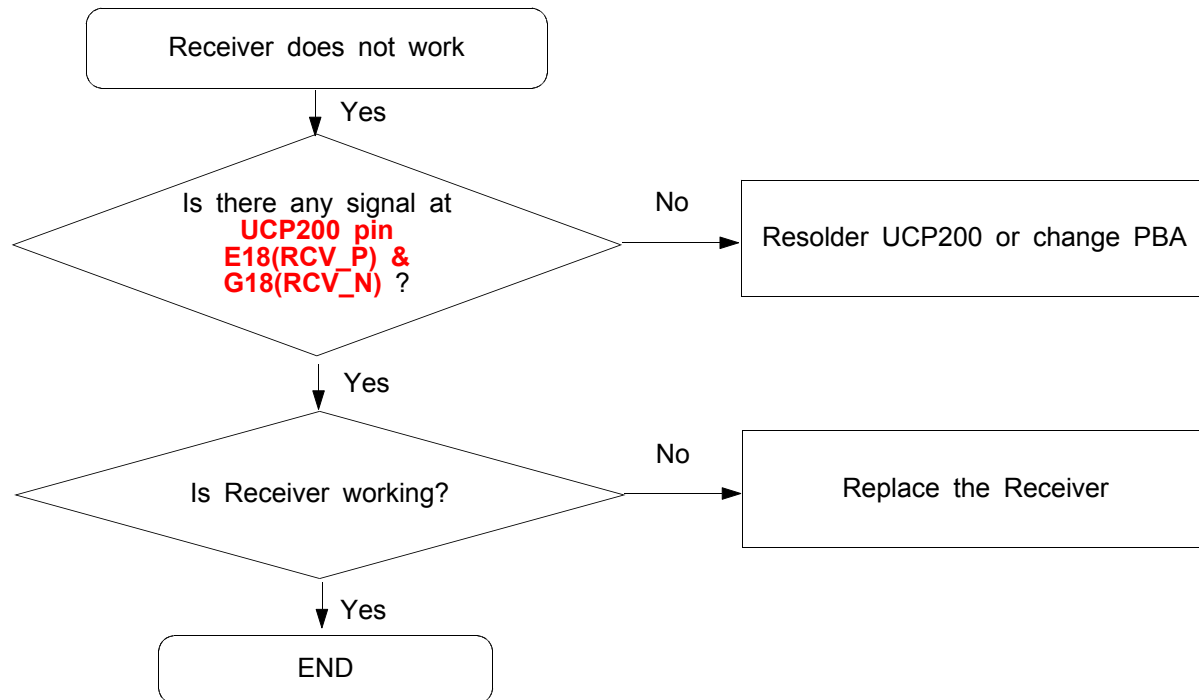


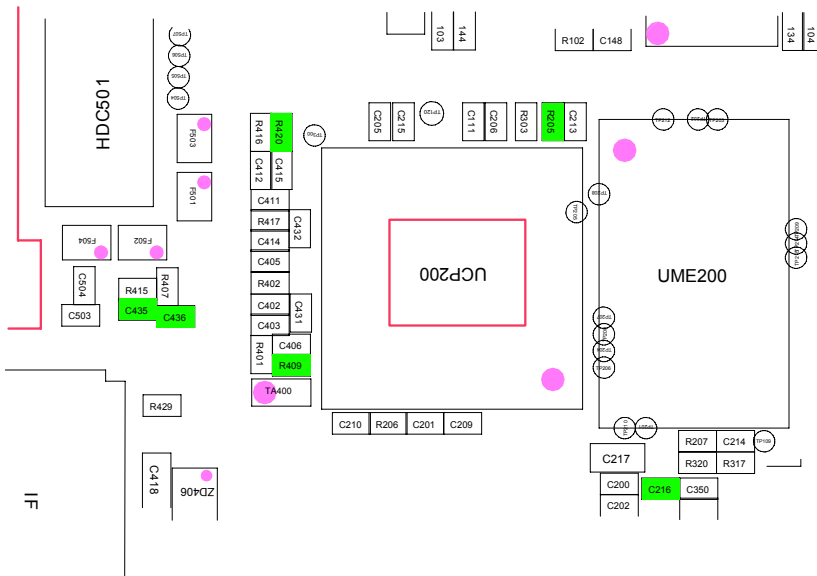
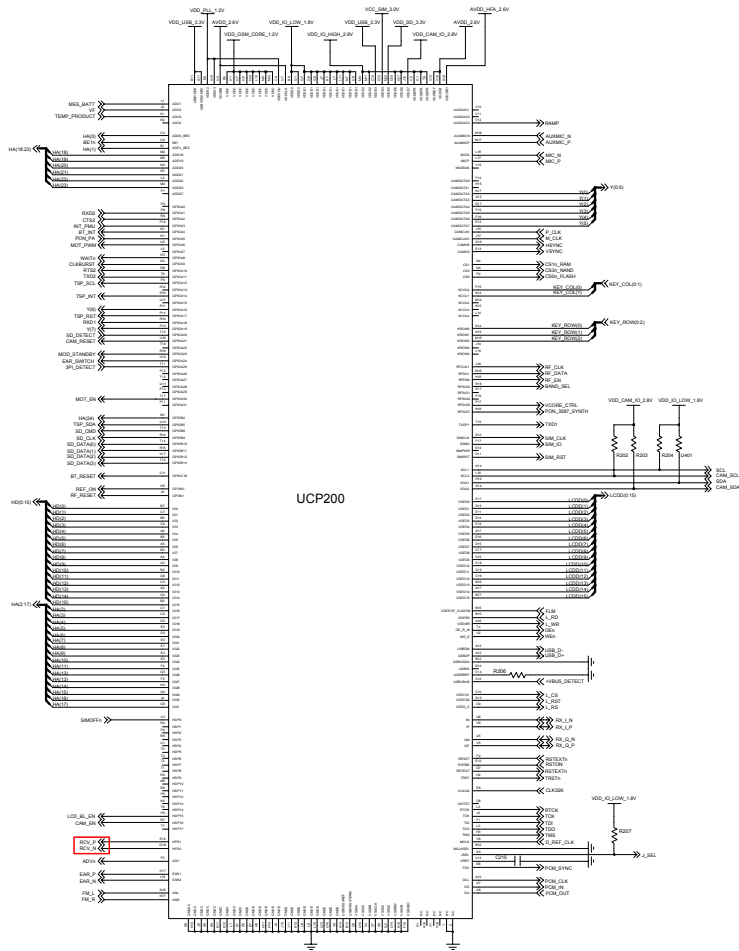
9-1-6. Speaker Part



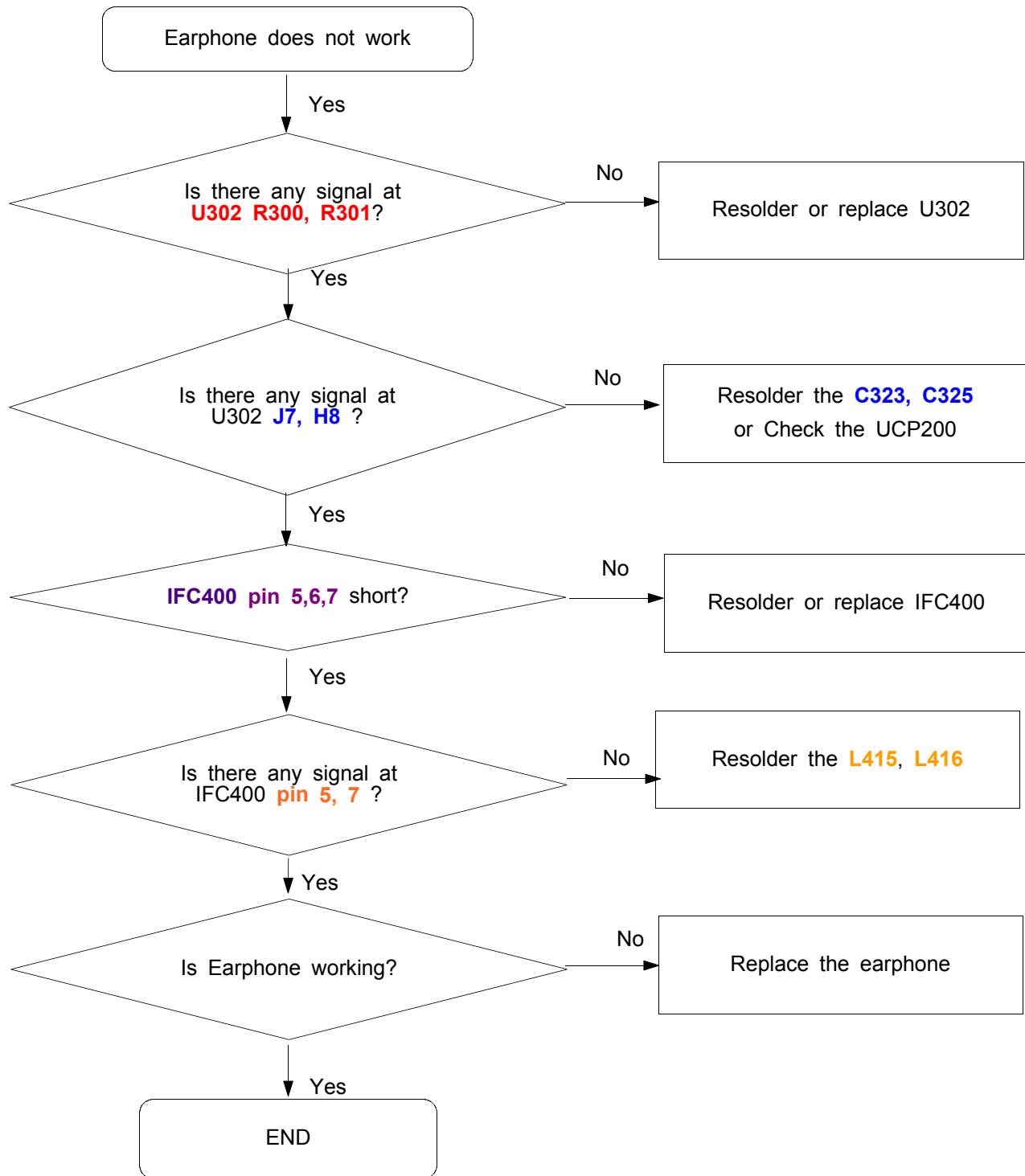


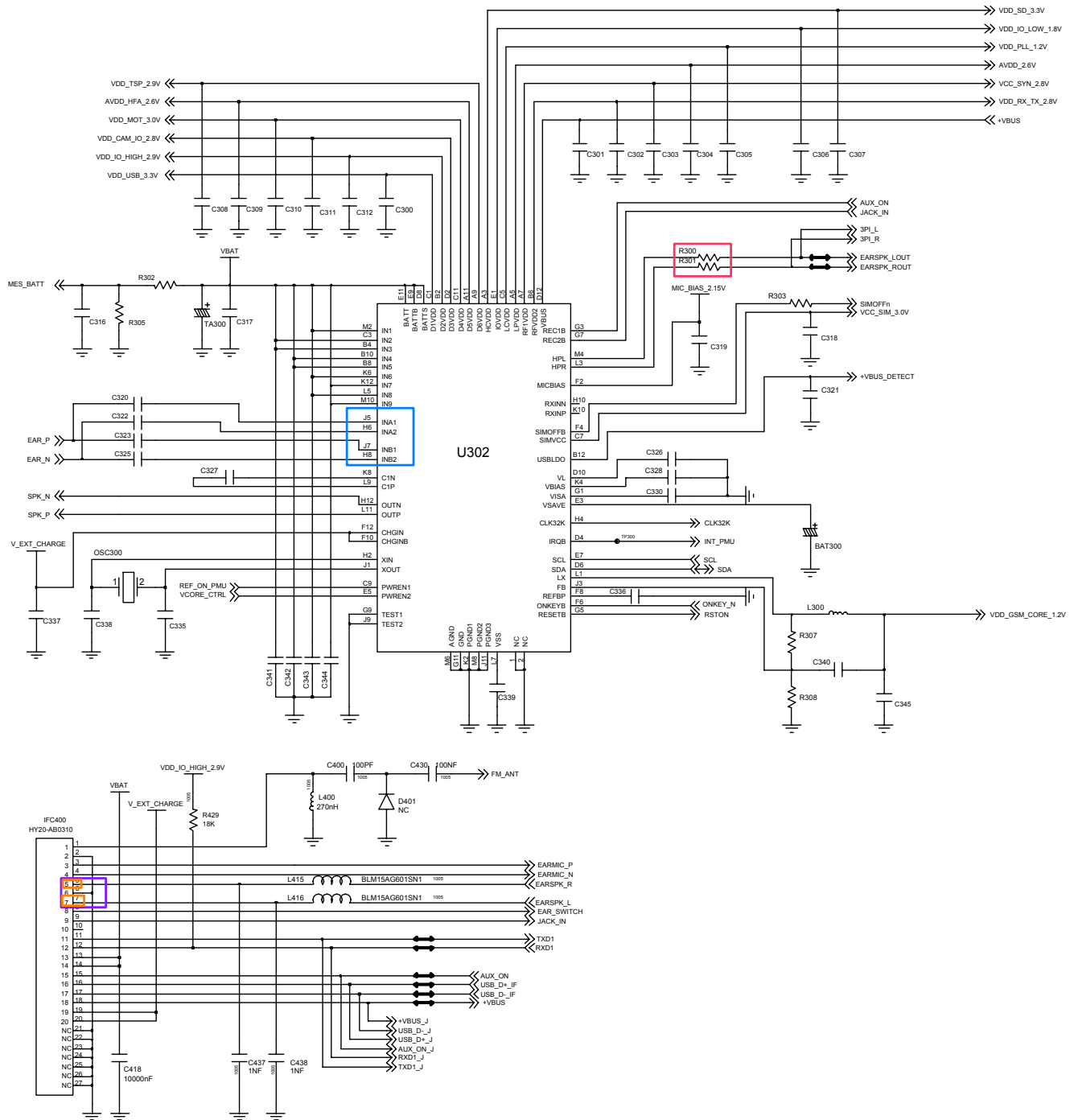
9-1-7. Receiver Part

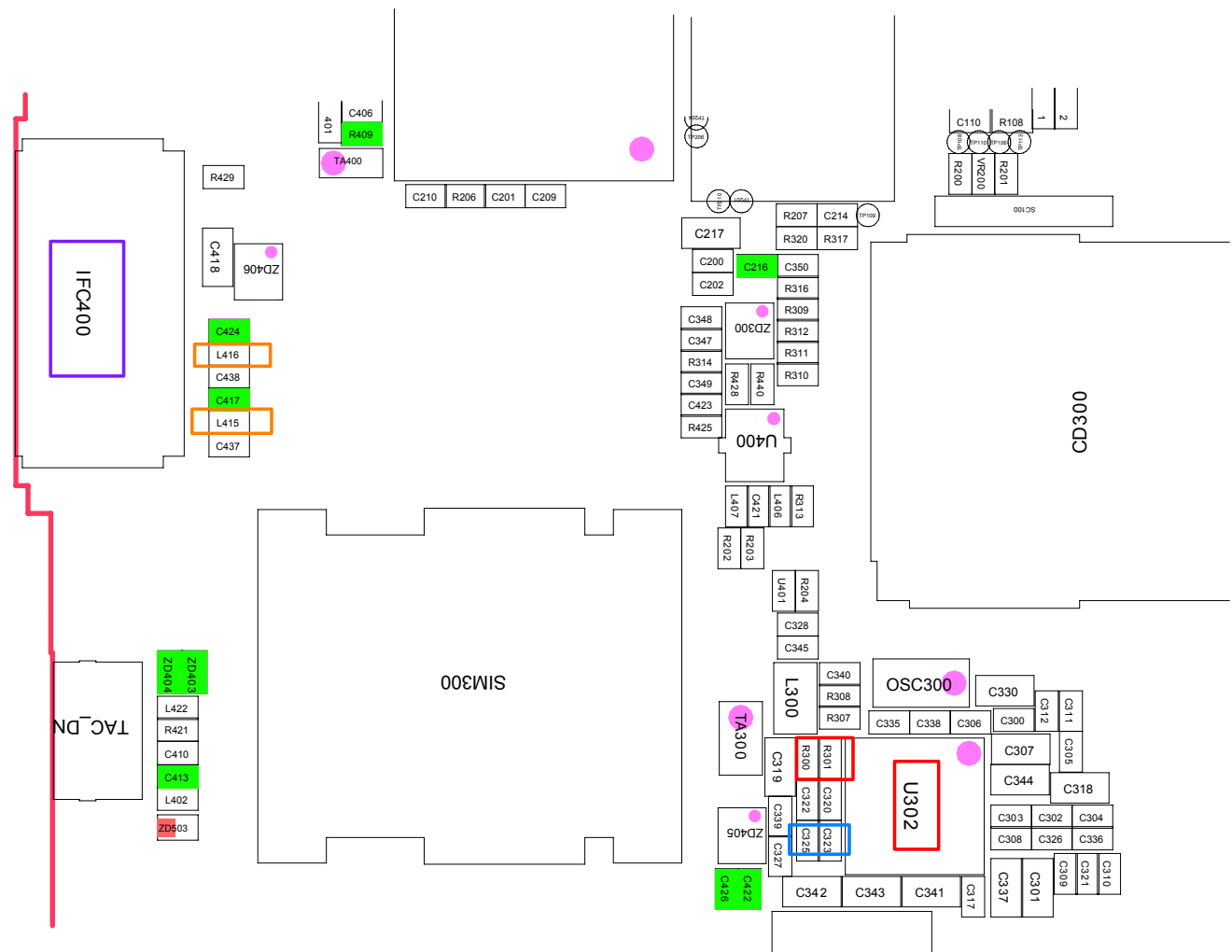




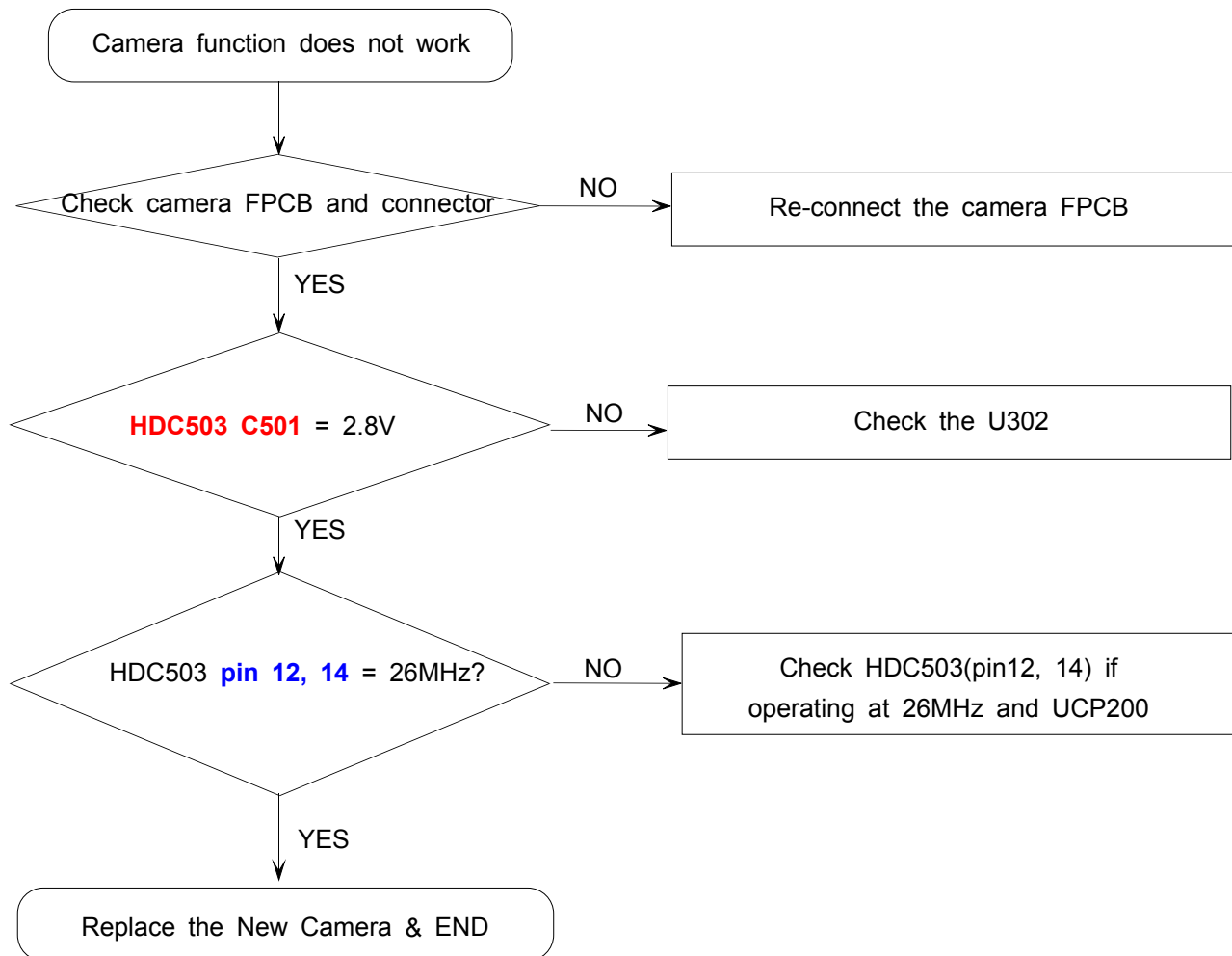
9-1-8. Headset Part

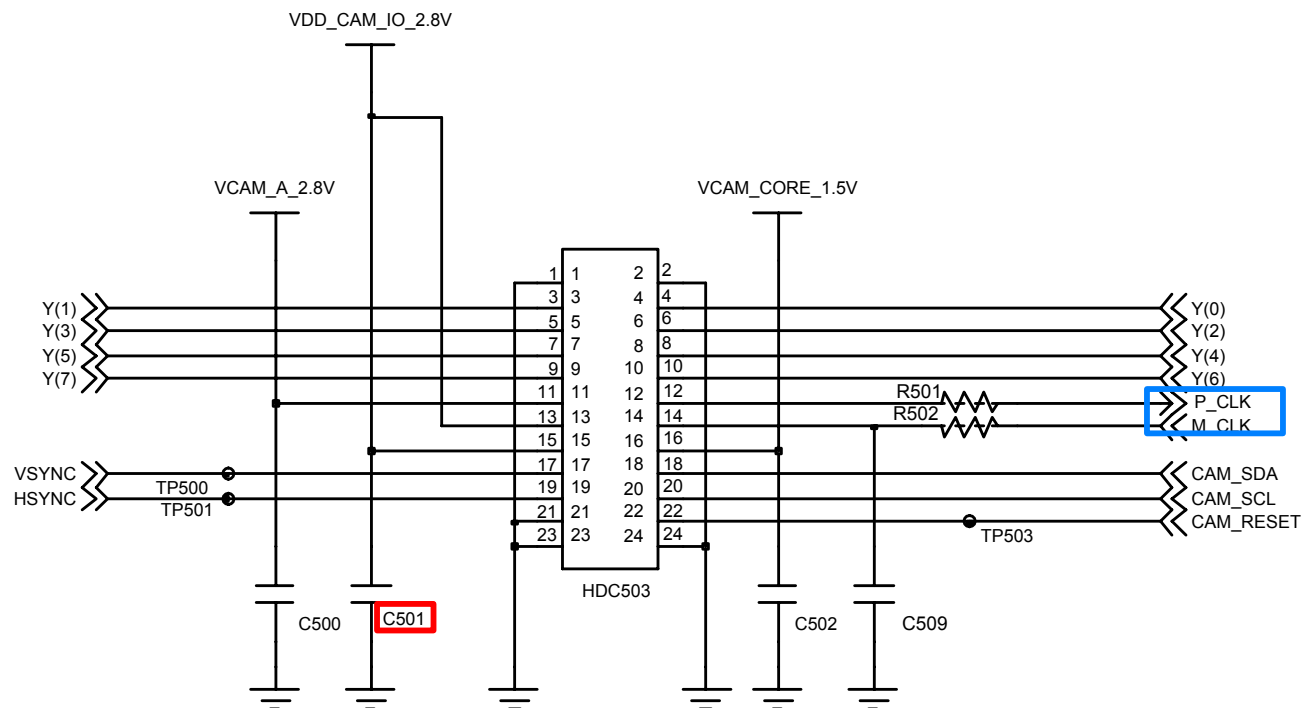






9-1-9. Camera Part (Mega and VGA)

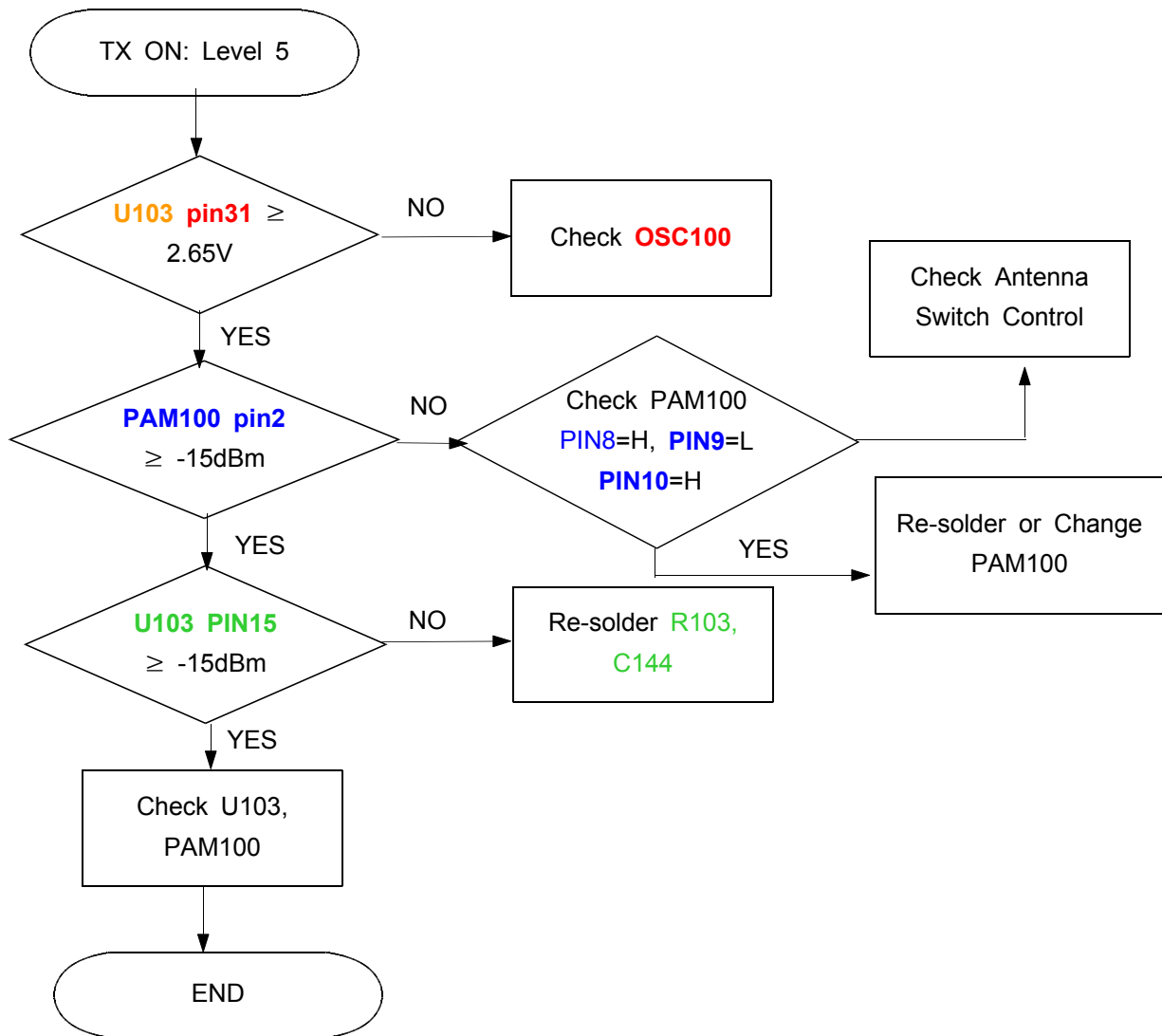


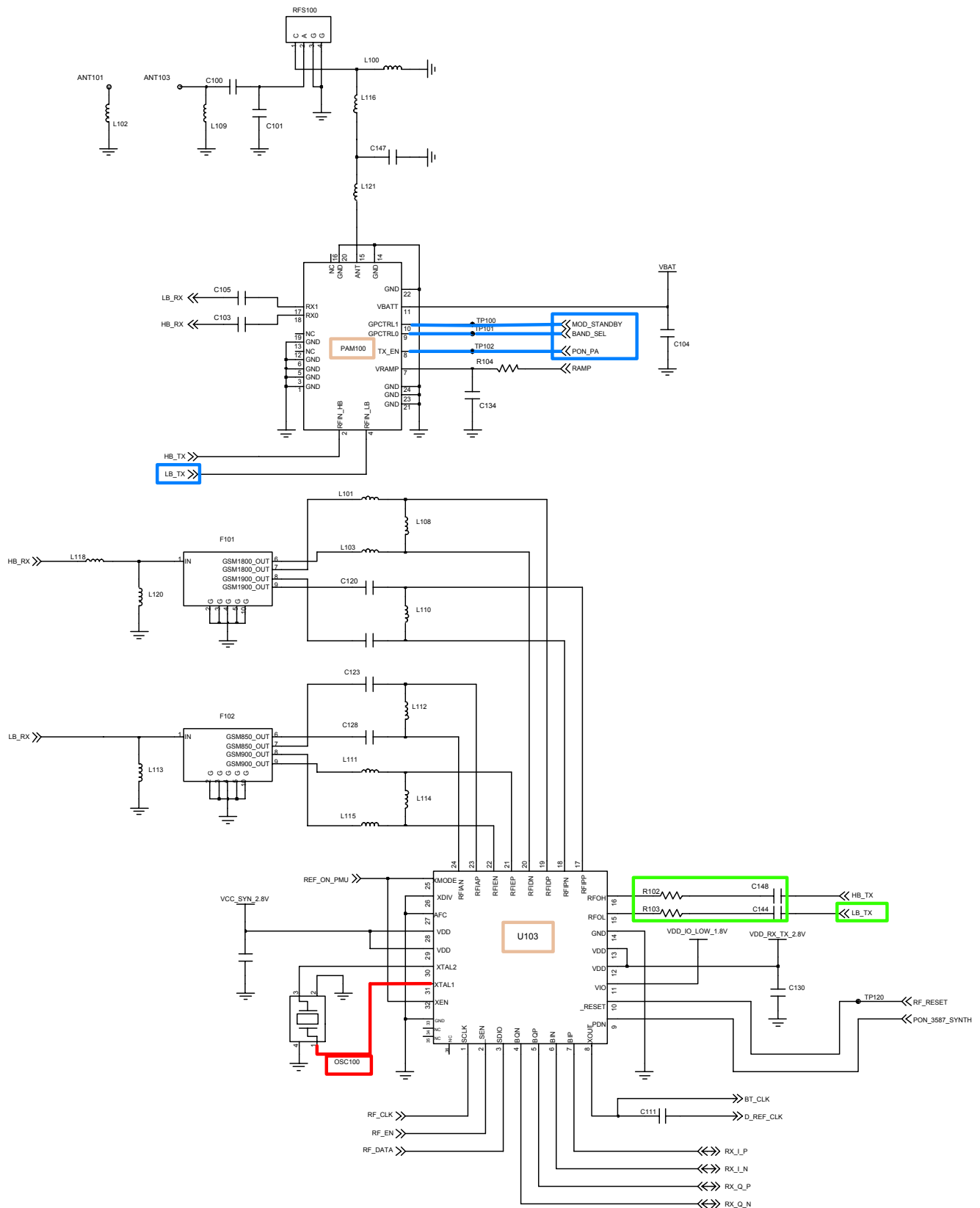


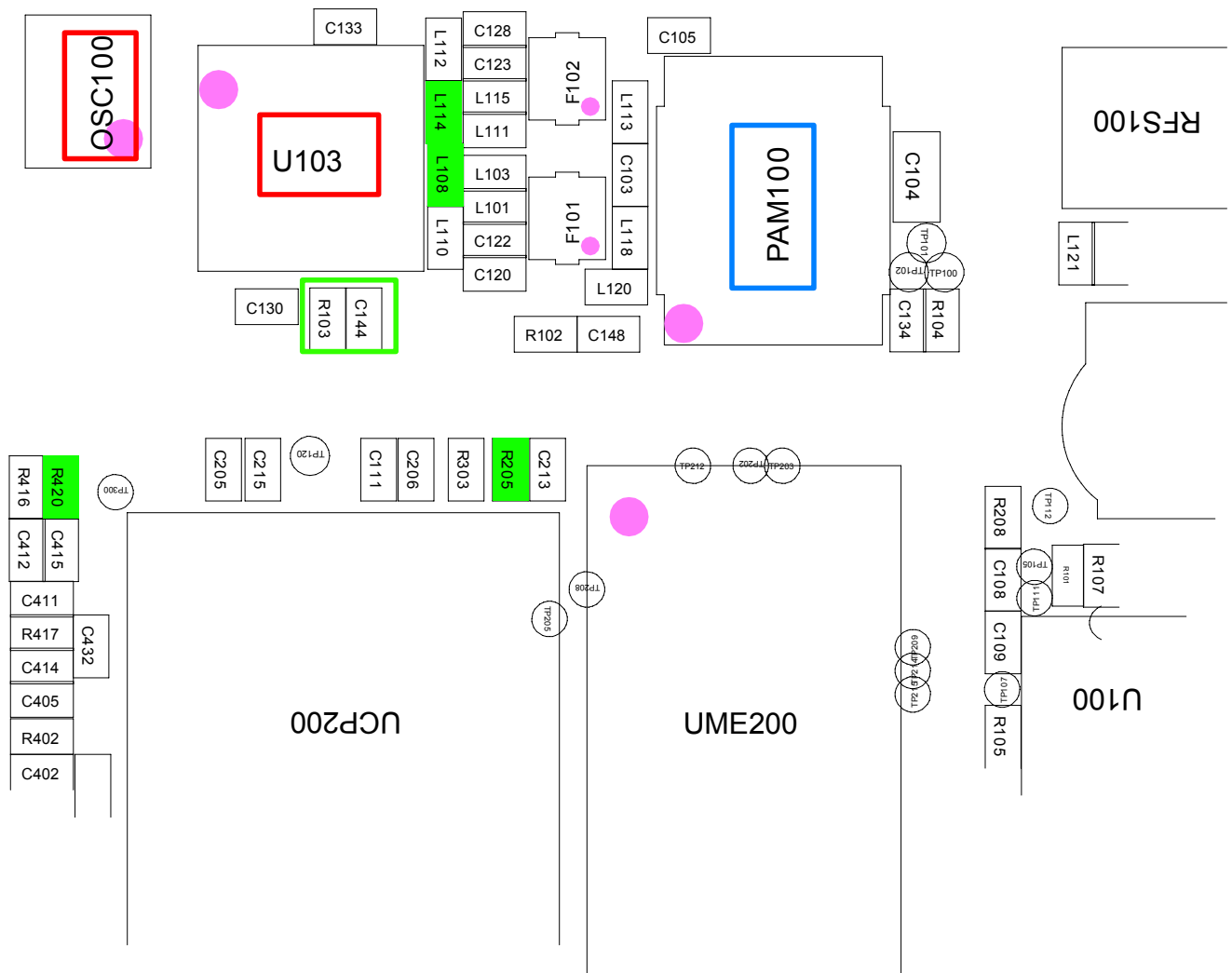
9-2. RF

** When testing TX chain, check ALL RF devices, resistors, inductors, and capacitors.

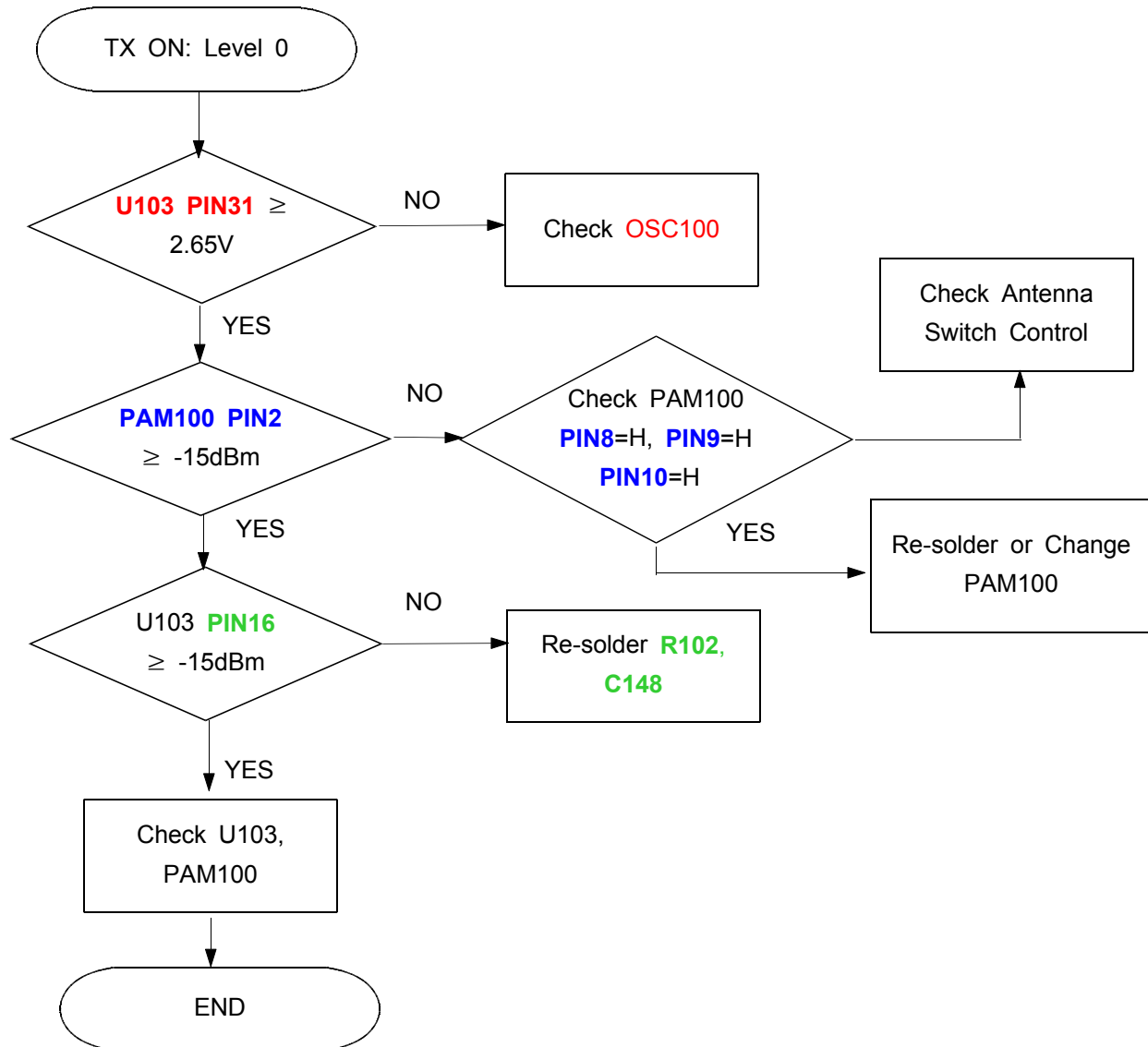
9-2-1. GSM850/GSM900 Transmitter

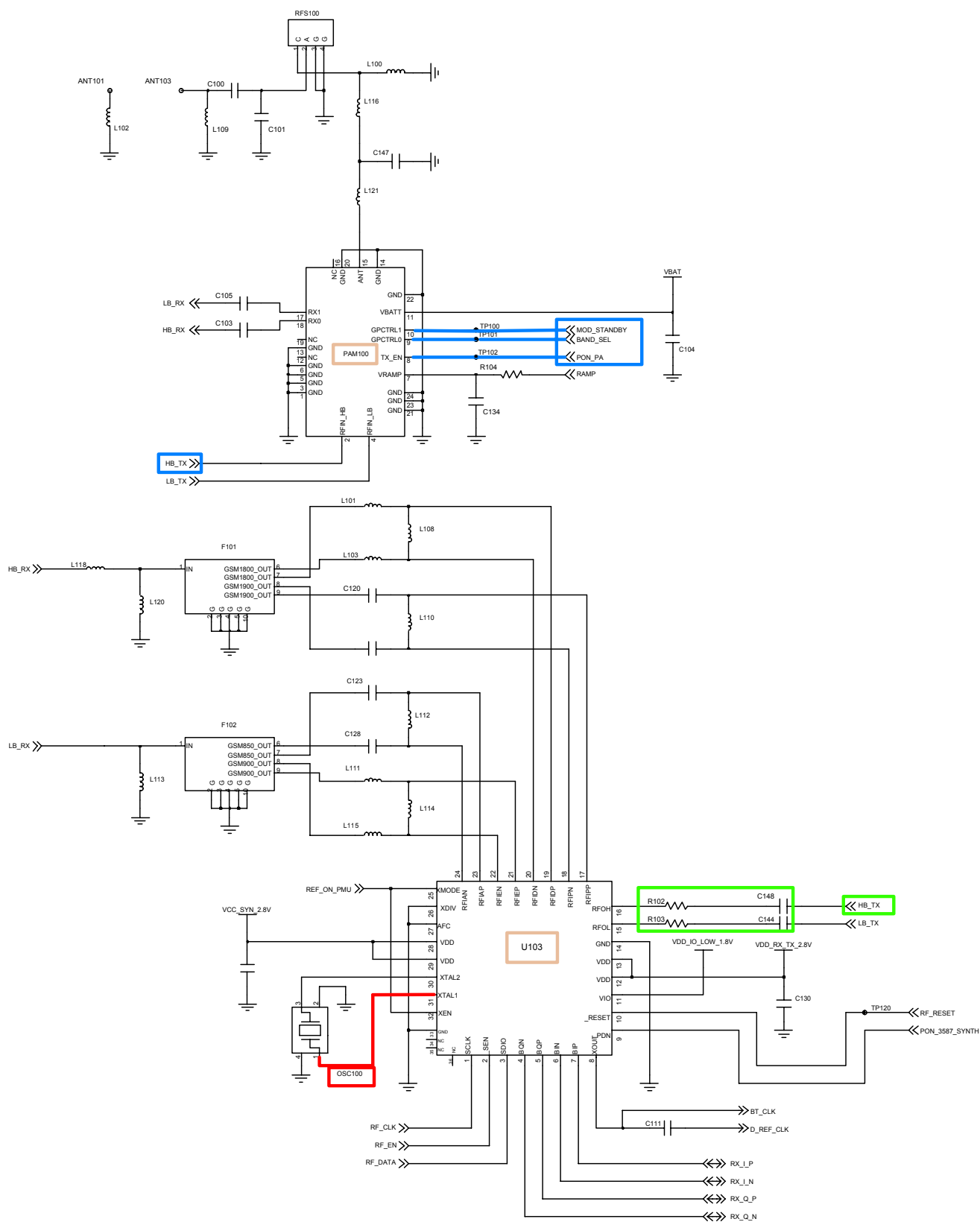




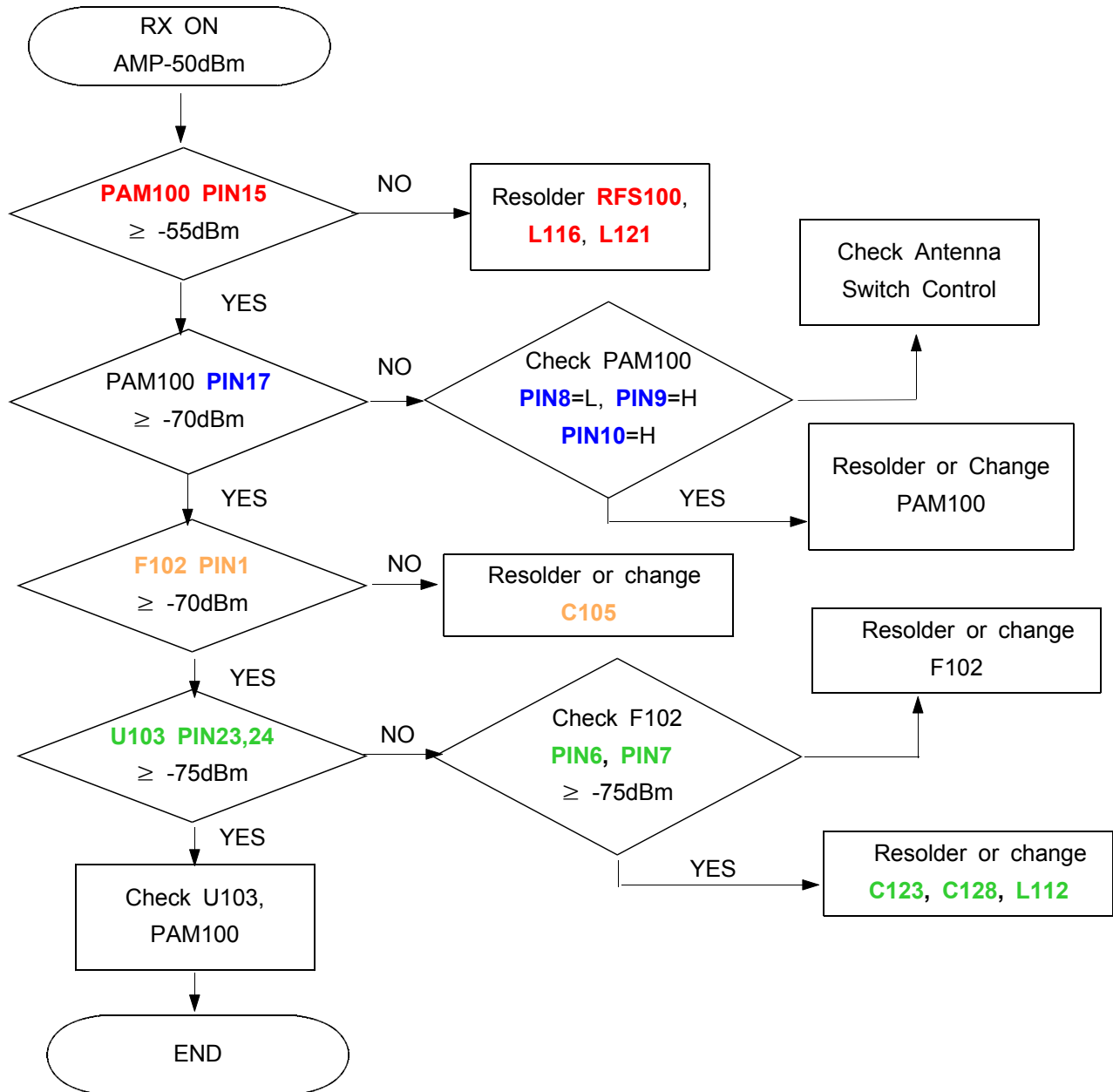


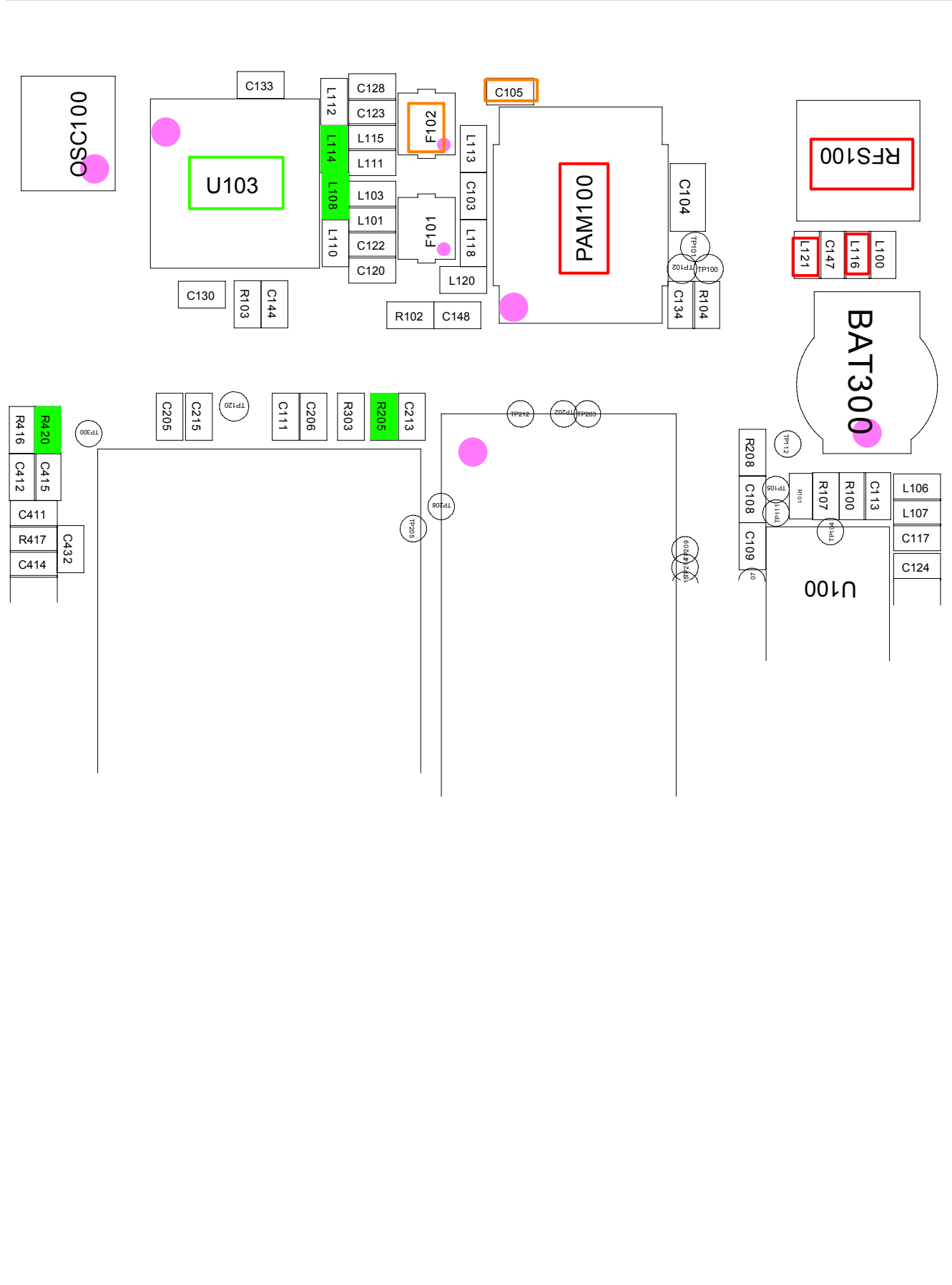
9-2-2. DCS1800/PCS1900 Transmitter



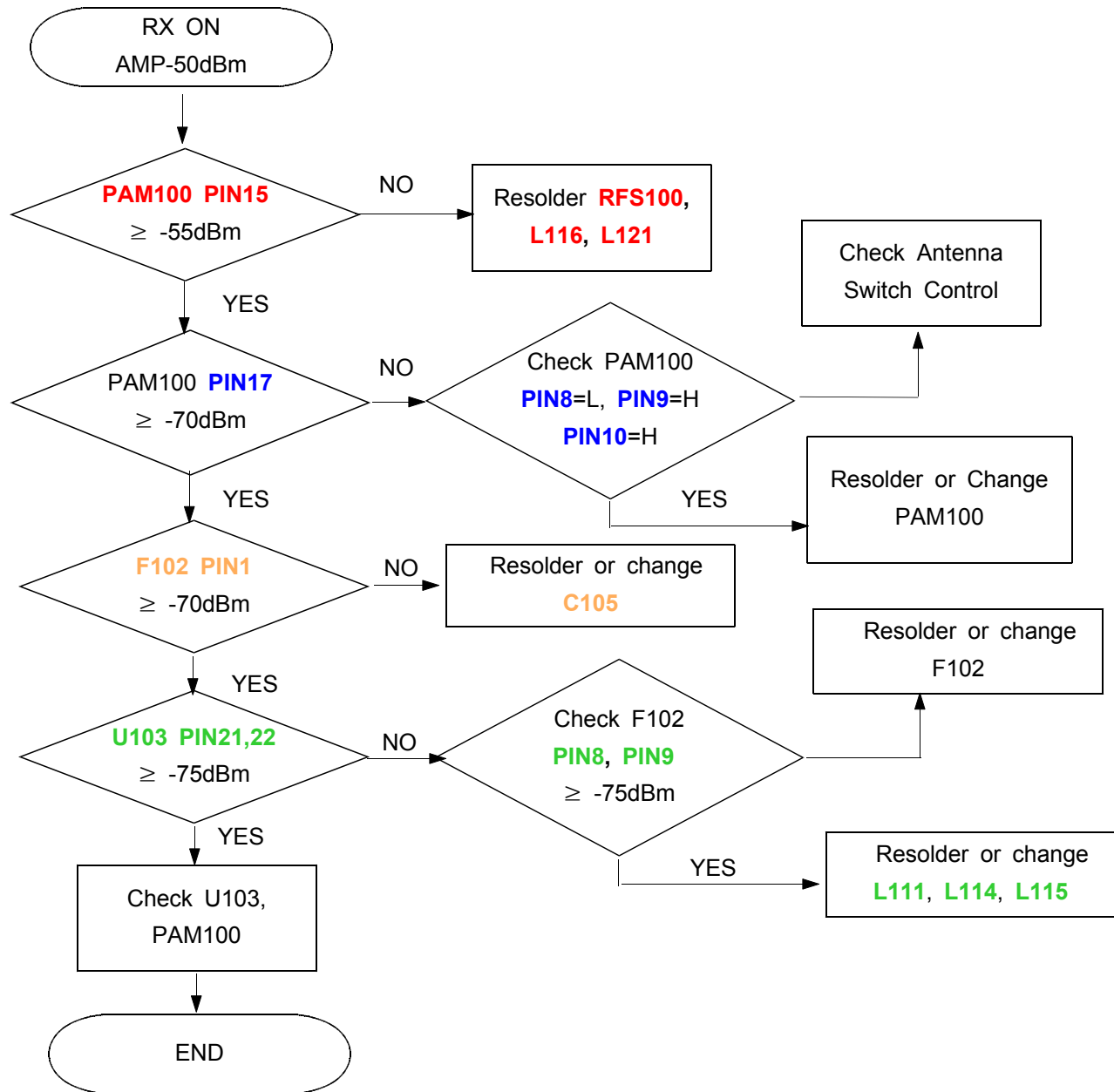


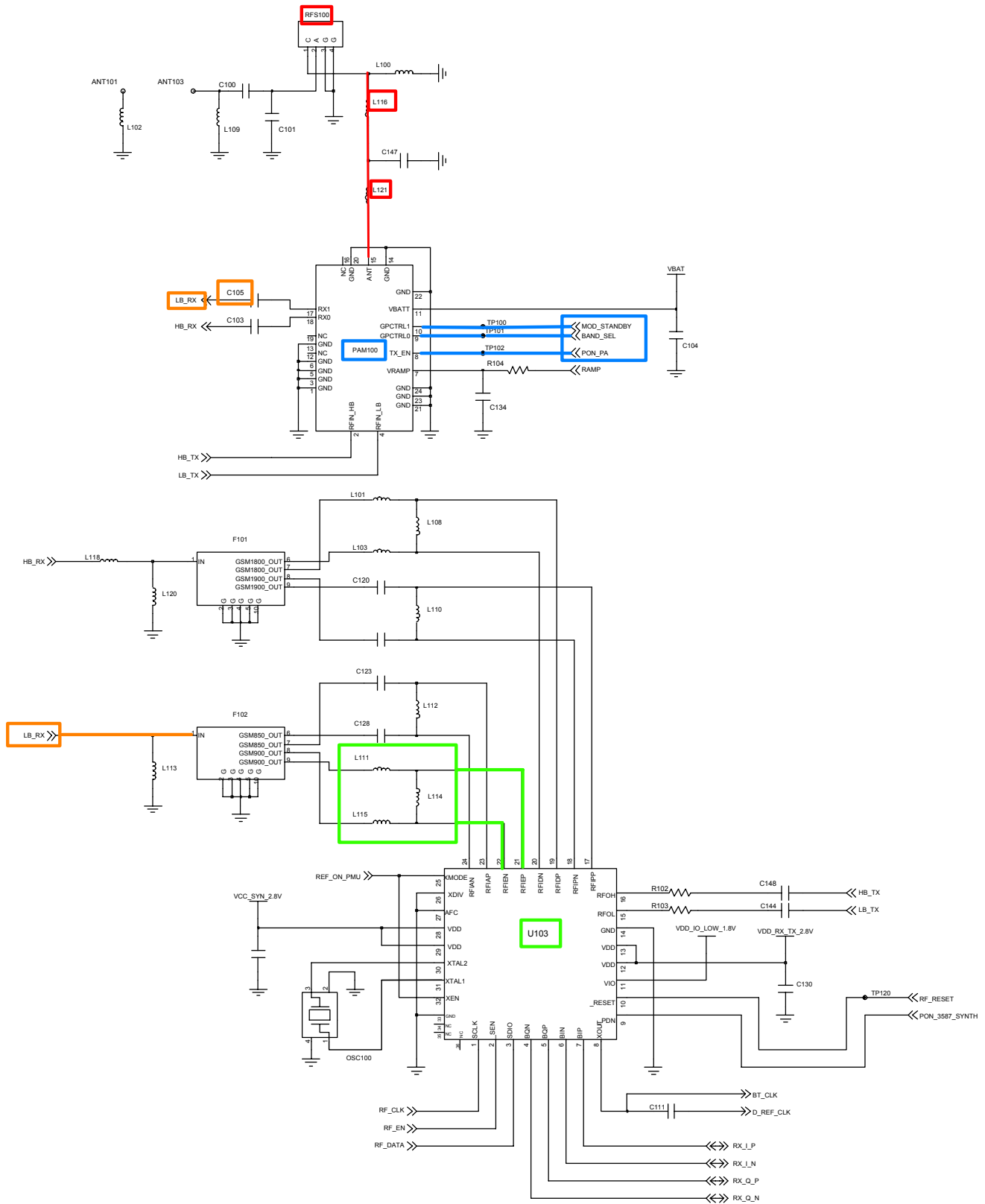
9-2-3. GSM850 Receiver

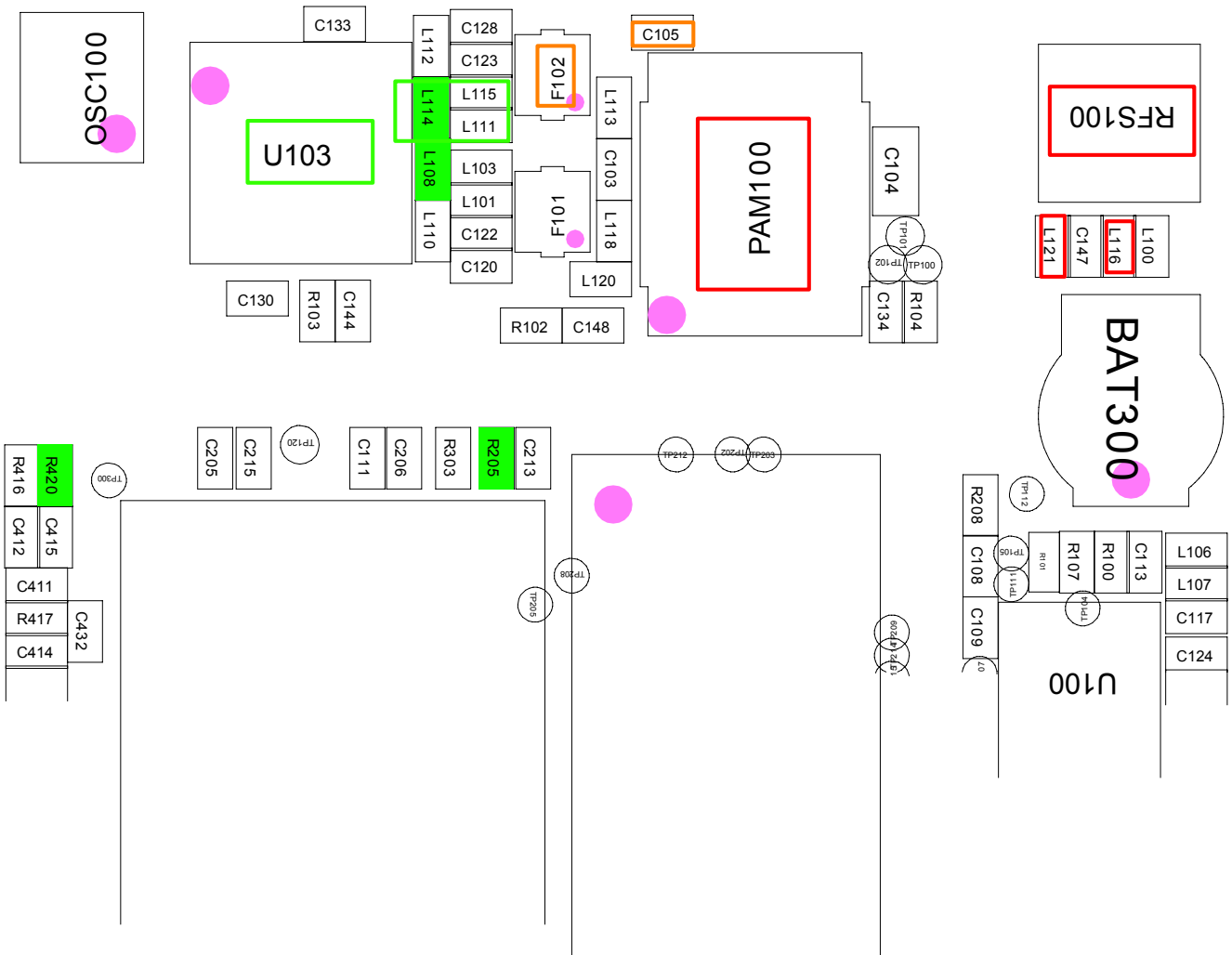




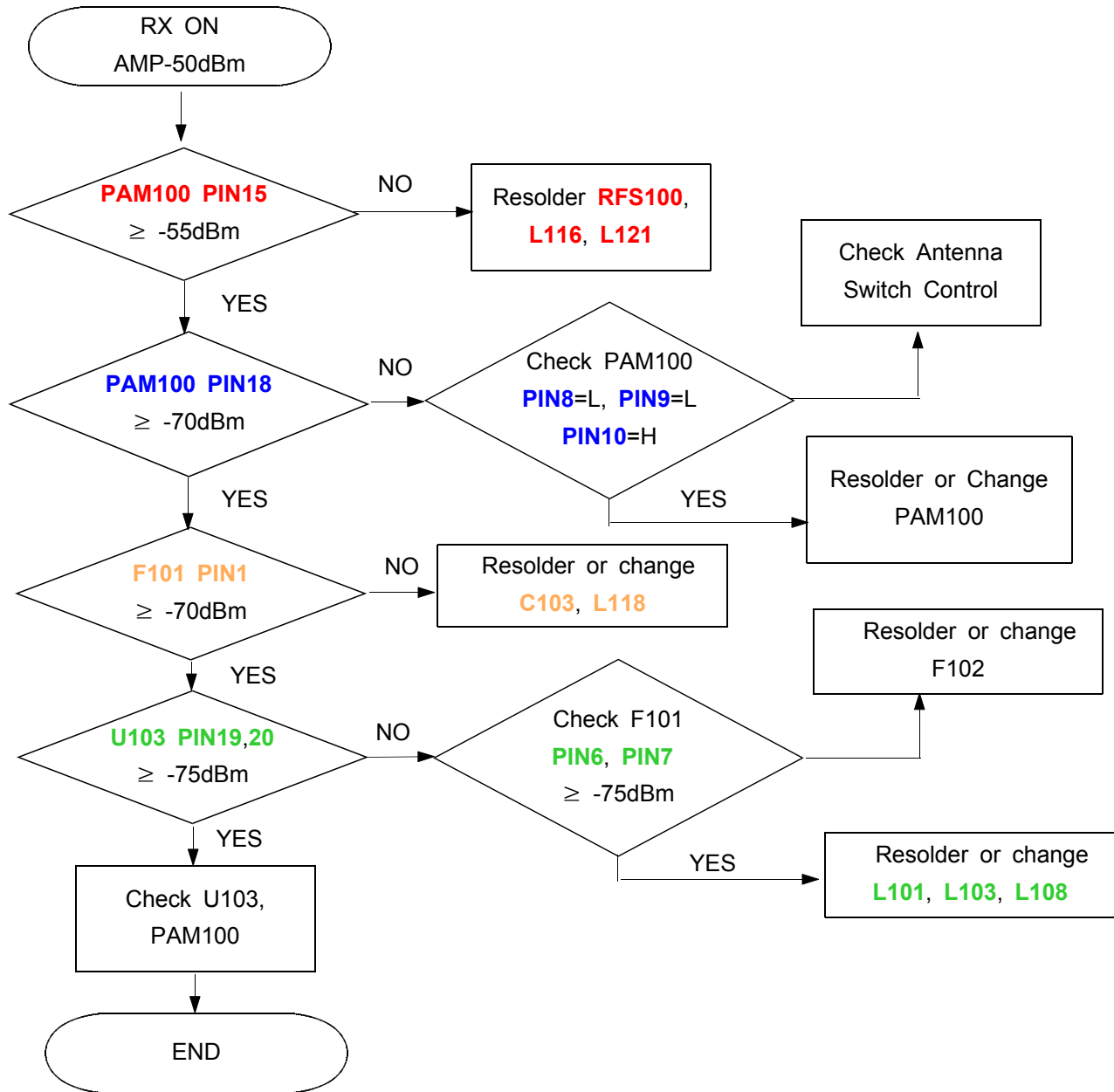
9-2-4. GSM900 Receiver

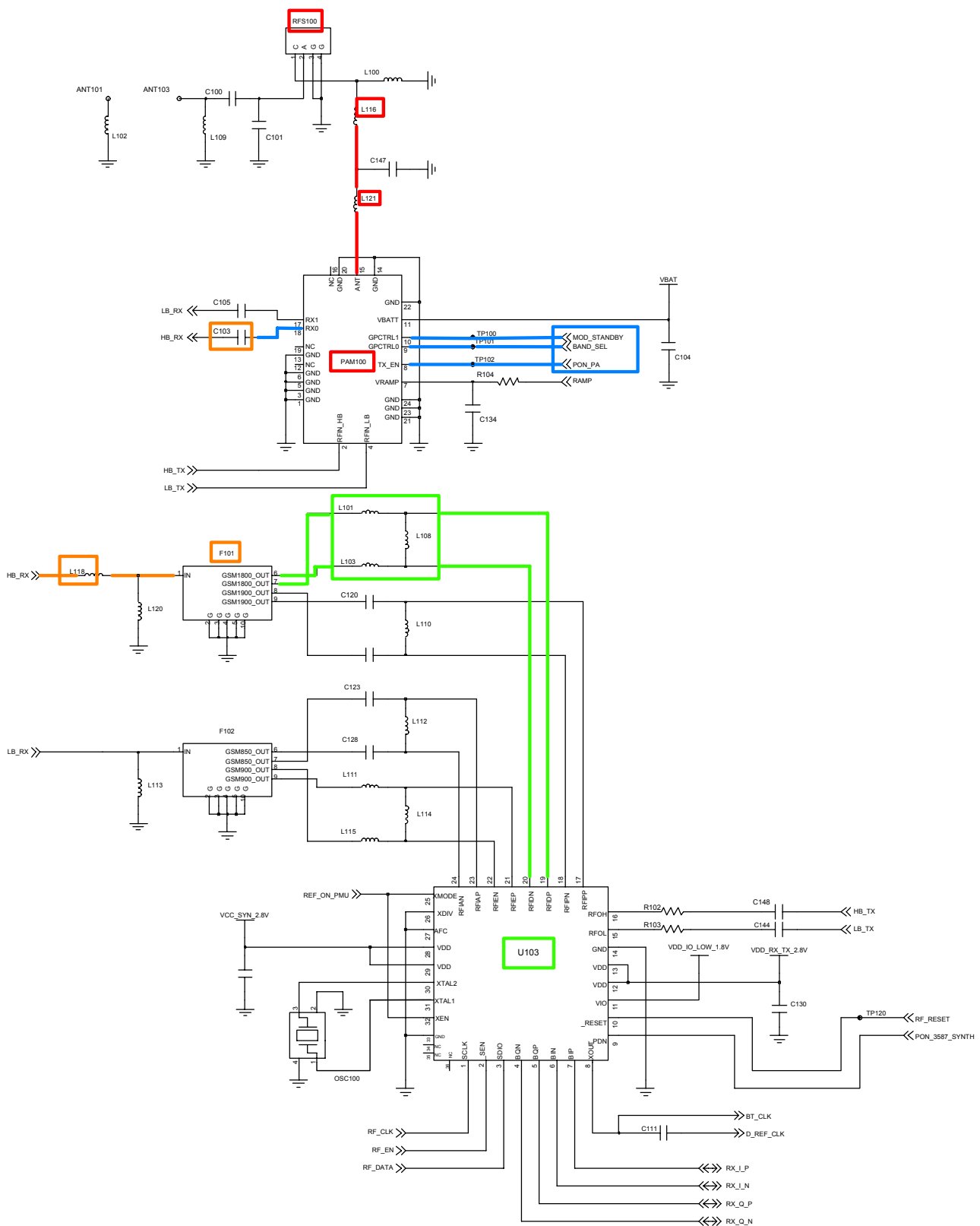


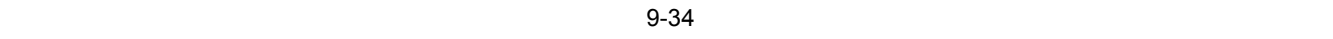




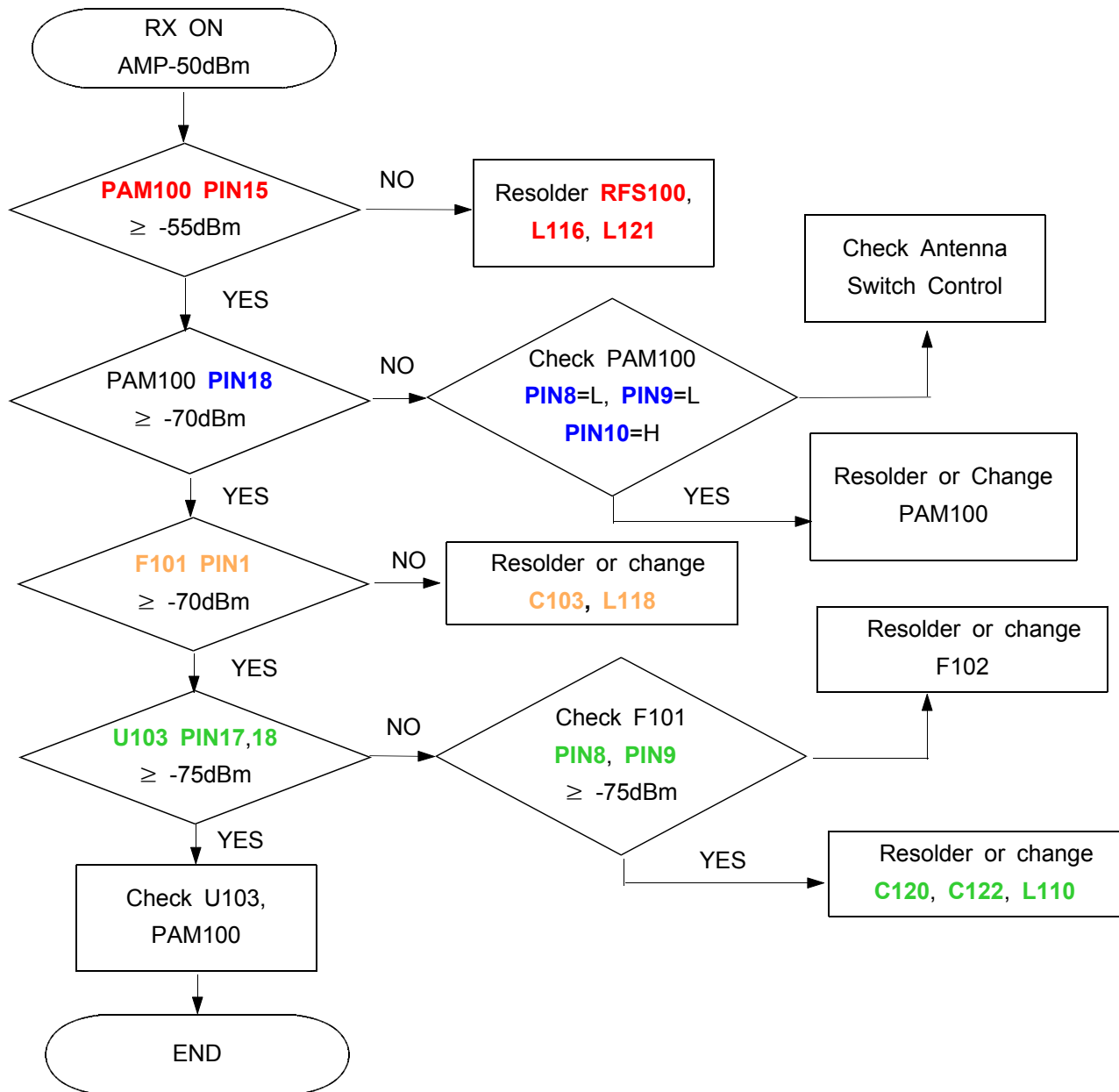
9-2-5. DCS1800 Receiver

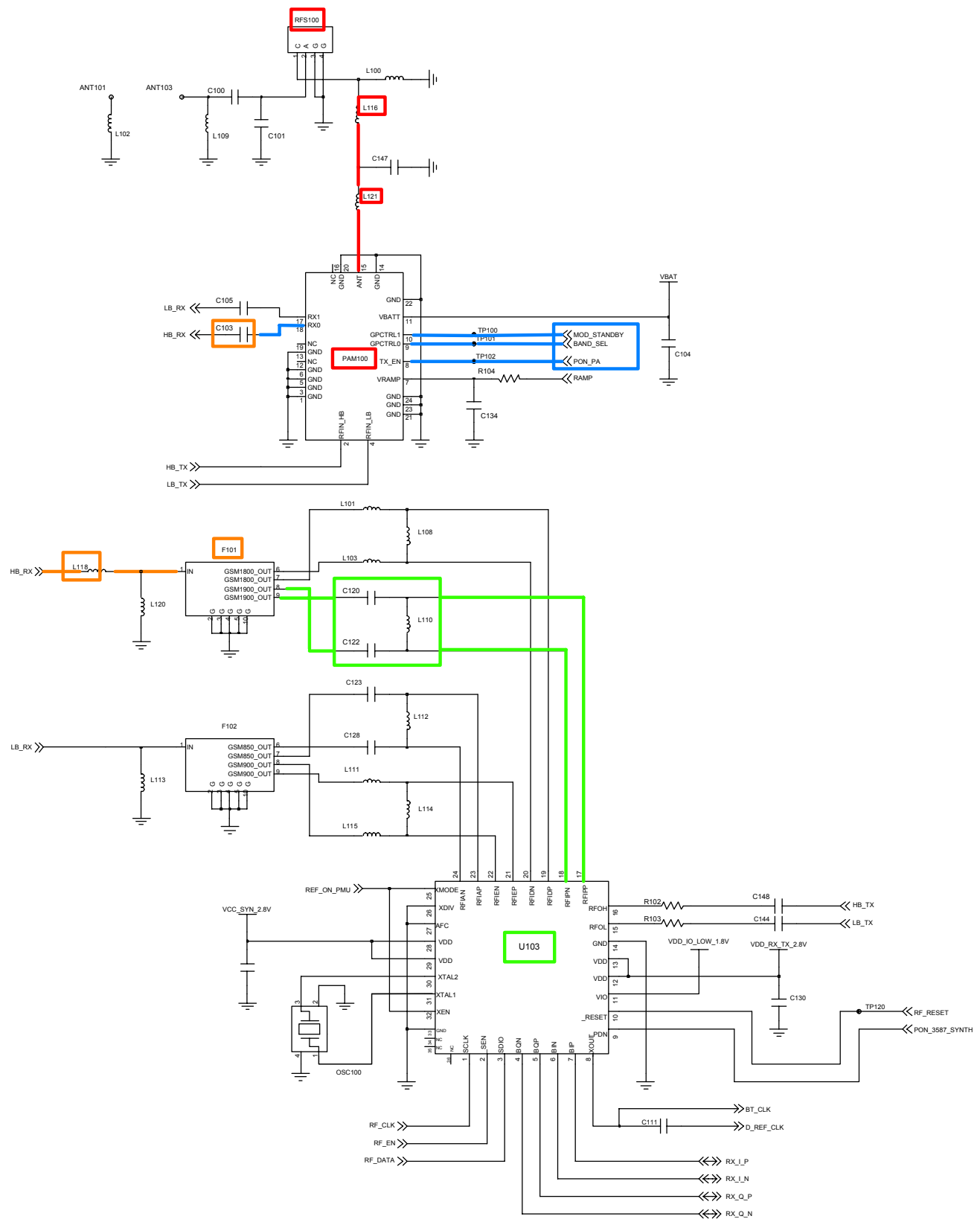




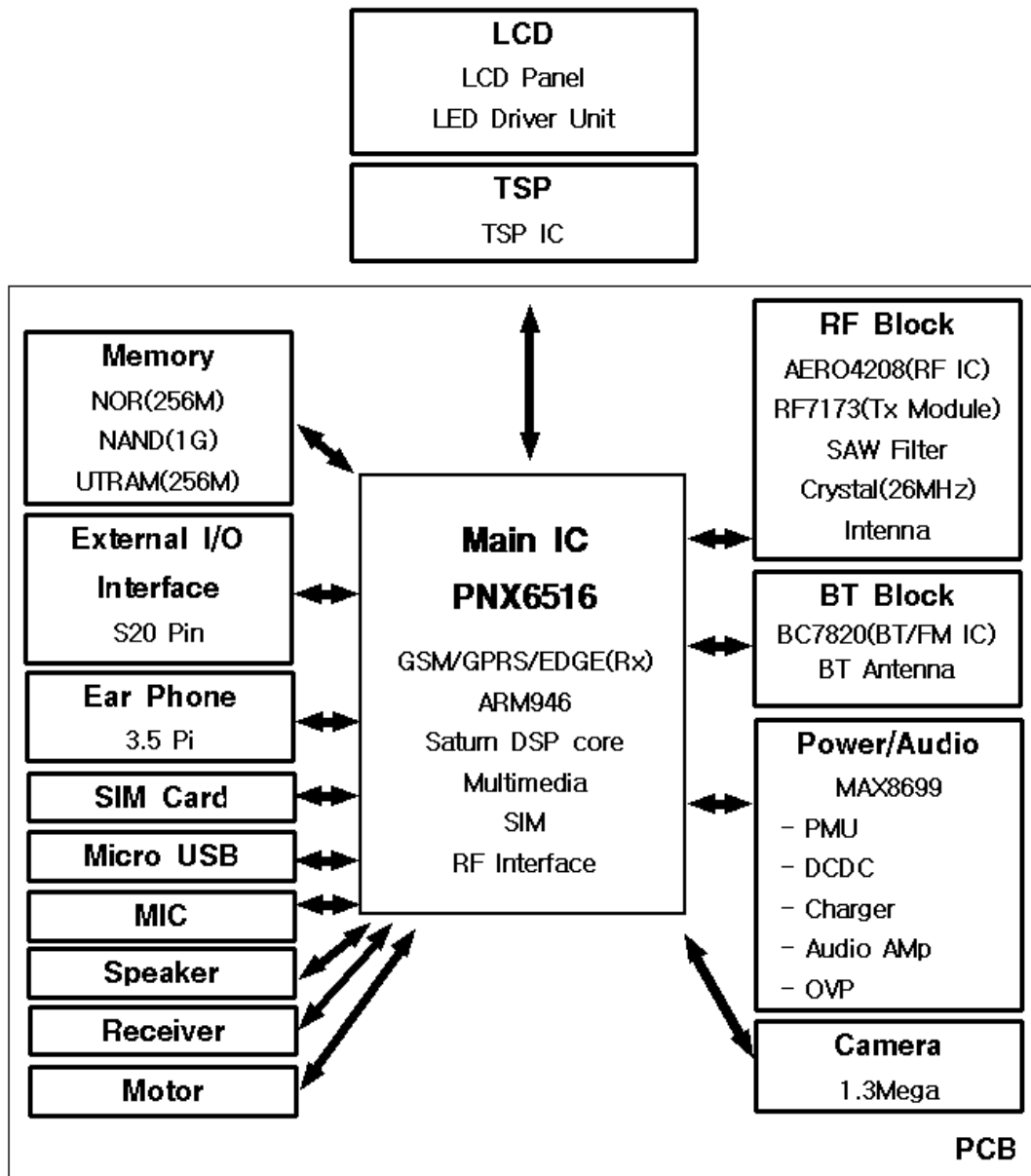


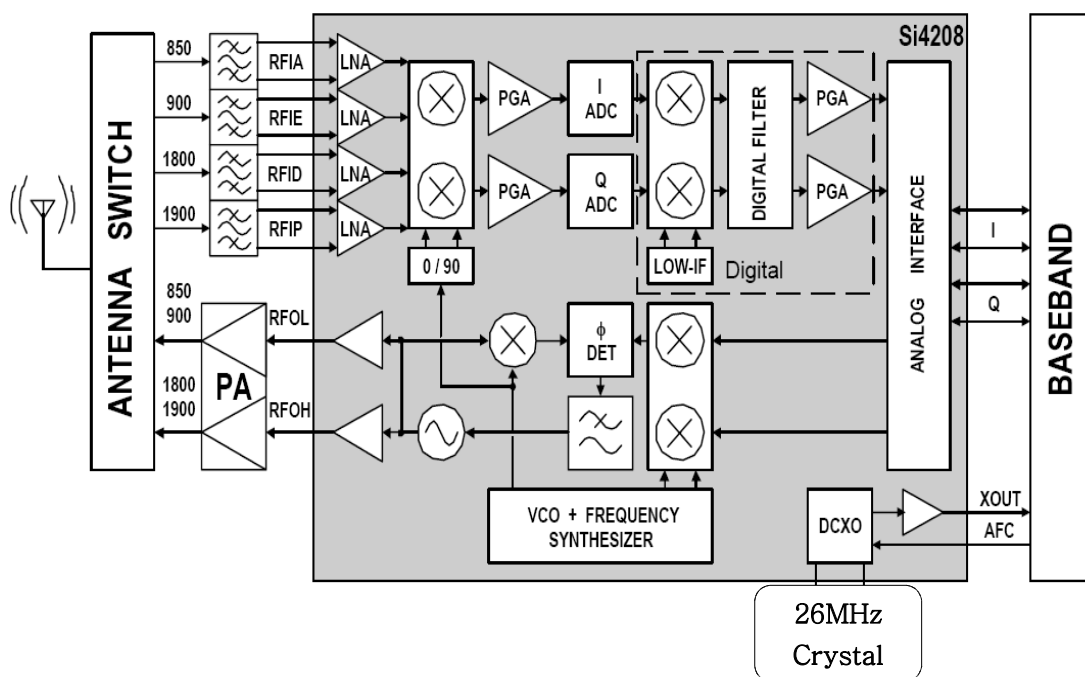
9-2-6. PCS1900 Receiver

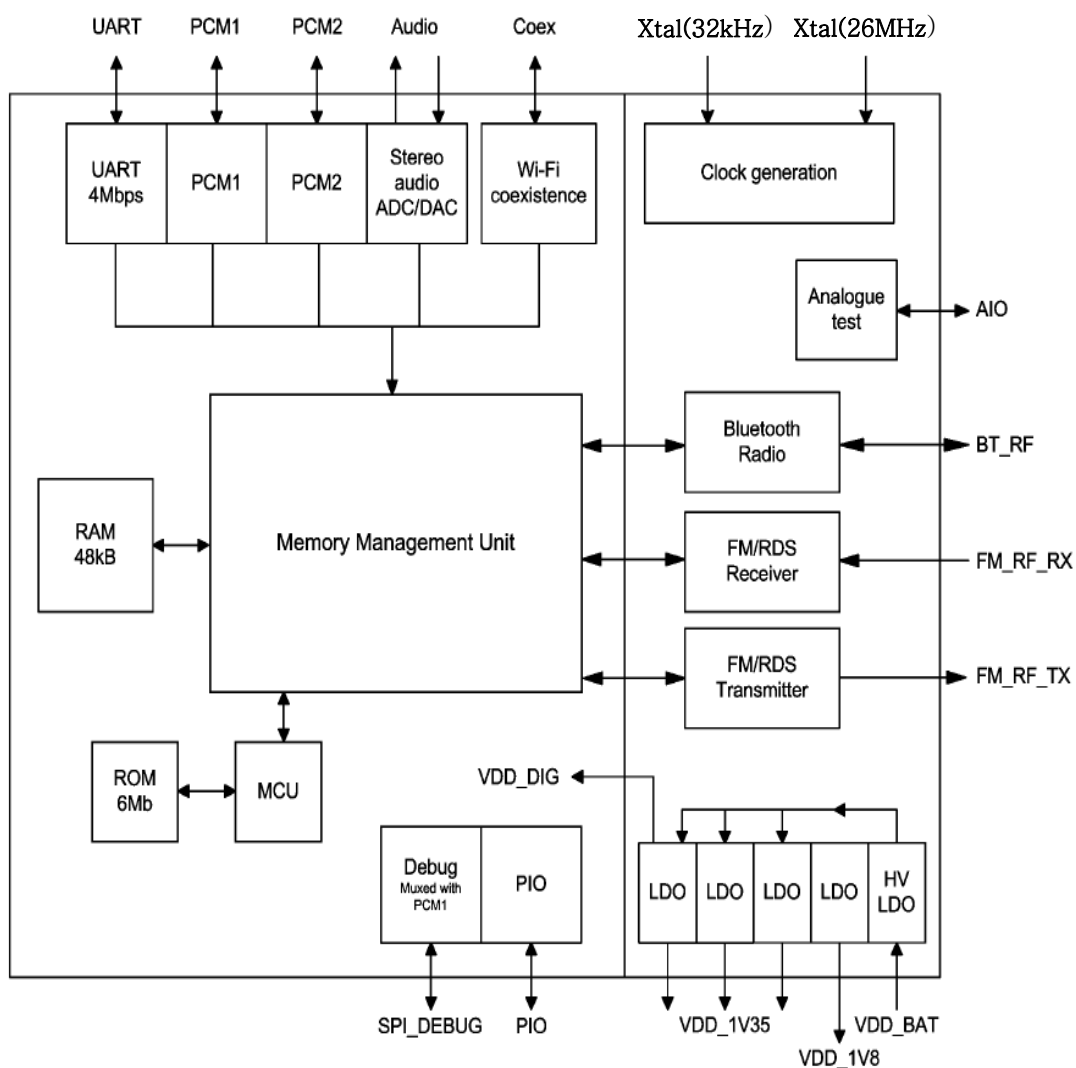




7. Block Diagrams







8. PCB Diagrams

8-1. Top

